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THE RELATIONSHIP OF FOREST SCENIC BEAUTY TO RECREATION VALUE

by

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FINAL REPORT

THE RELATIONSHIP OF FOREST SCENIC BEAUTY TO RECREATION VALUE

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This final report consists of the following items:

1. A manuscript titled "Perceived Scenic Beauty and Contingent Valuation of Forest Campgrounds" by Daniel, Brown, King, Richards, and Stewart. This manuscript has been accepted for publication in Forest Science.

2. A manuscript titled "Recreation Participation and the Validity of Photo-based Preference Judgments" by Brown, Daniel, Richards, and King. This manuscript has been accepted for publication in the Journal of Leisure Research.

3. A manuscript titled "The Relationship between Travel Cost and Contingent Value Estimates of Forest Recreation Value" by Richards, King, Daniel, and Brown. This manuscript has been submitted for publication in Leisure Sciences.

4. A manuscript titled "Scenic Beauty Models for Forest Campgrounds" by Richards, Wilson, Daniel, and Brown.

5. Campground interview form (photo-based scenic beauty responses).

6. Campground interview form (photo-based contingent valuation responses).

June 24, 1988

Perceived Scenic Beauty and Contingent Valuation of Forest Campgrounds

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ABSTRACT. Recreationists' photo-based scenic beauty judgments of 35 forest areas were compared with other recreationists' photo-based judgments of their willingness to pay to camp at the same areas. A nearly perfect linear relationship was found between the scenic beauty and willingness to pay judgments, indicating that respondents using either response mode were sensitive to the same variations in forest characteristics in providing their judgments, and that forest conditions do influence the value that recreationists verbally assign to their campground experience.

KEY WORDS: Forest Scenit beauty, forest recreation, recreation value, contingent valuation, forest campgrounds, ponderosa pine.

At least from the time of the National Environmental Policy Act of 1969 the US Forest Service has operated under a mandate to systematically consider aesthetics and outdoor recreation opportunity in the management of the National Forests. This mandate was reinforced and refined by the Forest and Rangeland Renewable Resources Planning Act of 1974 and the National Forest Management Act of 1976. Initial efforts to implement these policy directives focused upon the development of expert assessment systems (Daniel and Vining 1983, Zube et al. 1982) such as the Forest Service landscape architects' Visual Management System (USDA 1974) and the Recreation Opportunity Spectrum (Buist and Hoots 1982). These systems produce categorical classifications of forest areas based upon an expert evaluation of the characteristics of the area. The resulting classifications typically enter the planning process as part of the inventory of resources and in the form of general guidelines and constraints to management actions.

While recreation opportunity and scenic beauty are sometimes treated as separate concerns in legislation and management guidelines, they are frequently considered to be closely related and occassionally even synonymous. For example, more stringent visual quality objectives may be justified to protect recreation values, and recreation use of an area will usually increase the assigned "sensitivity" of the area to visual/scenic impacts.

The relationship between aesthetic or scenic quality concerns and recreation value is important for several reasons. Depending upon the nature of that relationship, forest management actions to achieve scenic quality objectives could conflicts with recreation values. Alternatively, if scenic beauty and recreation value were very closely (positively) related, then assessments of the scenic and recreational consequences of management actions could be redundant, potentially resulting in a "double-counting" of benefits. In any event, effective management of important scenic and recreation resources requires a clear understanding of their interrelationships, and means to predict with considerable precision the effects on either or both that are exected to occur as a result of management changes in the forest.

Brown and Daniel (1984) hypothesized that the relationship between scenic quality and recreation value could be represented as a contiuum. At one extreme, the value of recreation activities such as "driving for pleasure" and "picnicing" may rely heavily on the scenic quality of the environment in which those activities take place. At the other extreme, the value of recreation activities that have a strong performance element, such as abseiling or white-water kayaking may have a lesser dependence on the scenic quality of the surrounding environment. Taylor and Daniel (1984) found some evidence of such a continuum in scenic beauty to recreation value relationships in the context of a study of public perceptions and attitudes toward the effects of fire on forest

environments. Fire was found to have very similar effects on perceived scenic beauty and judged quality of forest areas for picnicing. The relationship was not so strong between scenic beauty perceptions and judgements for the quality of forest areas for hiking or for nature study. While both scenic beauty and suitability for camping were similarly affected by less severe fire (low intensity burn) camping quality judgement were more adversely affected by more severe fire (high intensity burn) than were scenic beauty judgements.

The continuum hypothesis seems intuitively appealing, and there is some data that is supportive. There are other findings, however, that indicate that the relationship between scenic beauty and recreation value may be more complex. For example, Wellman, et al. surveyed recreators engaged in back-packing and others engaged in off-road vehicle use, two activities that might be viewed as near the opposite extremes of the scenic-beauty dependence contiuum. Somewhat suprisingly (especially to managers who were asked to estimate the values of the two recreator groups), both groups indicated that enjoying natural scenery was the most important reason for their recreation activity.

The value of forest camping experiences would certainly seem to depend to some extent on the scenic quality of the surrounding forest landscape. At the same time there are undoubtedly other important factors not related to scenic beauty, including; the number, quality and condition of physical facilitites such as toilets, tables and fireplaces, and parking and camp sites; the social conditions at the site, such as crowding and noise, privacy, and interactions with friends and family; and special features such as streams or lakes, the quality of fishing, wildlife viewing opportunities, and access to archeological sites. Thus, the relationship between forest scenic beauty and the value of forest camping experience is not necessarily direct. Indeed, the relationship may well be quite complex. Determining the relationship between scenic beauty

and the value of forest camping experiences will require relatively precise assessments of both in the context of specific changes in relevant conditions at forest camping sites. Traditional categorical classification of scenic and recreational values, based on qualitative analyses, are not sufficient for investigations of the complex relationship between these two important forest resources. More precise, quantitative methods of assessment are required. Two methods that offer the needed precision and the opportunity to tie both scenic beauty and value of camping experience ot changes in specific features of the forest are the "psychophysical" method for assessing scenic beauty, developed by environmental psychologists, and the "contingent value method", developed by resource economists for assessing the value of camping experience.

The Scenic Beauty Estimation method (Daniel and Boster 1976) assesses scenic beauty in terms of the perceptual judgments of observer panels. Like the contingent value method, survey respondents are sampled from some population of interest and asked to indicate their judgments and preferences for different levels of environmental quality. Environmental conditions are typically represented by color slides or prints and respondents indicate their judgments using a 10-point rating scale. Responses of a number of respondents are subjected to a psychometric scaling routine and then aggregated to provide a standardized (interval scale) index of preference or perceived quality. Historically, this basic methodology has been applied in a number of environmental assessment contexts (e.g., Shafer 1964, Peterson 1967, Kaplan et al. 1972, Daniel et al. 1973, Shafer and Richards 1974, Zube 1974). Recent applications (e.g., Schroeder and Daniel 1980, Benson and Ullrich 1981, Buhyoff et al. 1982, Vining et al. 1984, and Brown and Daniel 1986) have shown the method to be reliable for gauging the effects of forest management practices on public perception of scenic beauty of forest areas.

The contingent valuation method is based on eliciting individuals' responses to hypothetical markets. In a typical application respondents are asked their "willingness to pay" for different levels of environmental quality (e.g., levels of scenic beauty, air quality, water quality, or access to various recreation opportunities). The environmental quality levels may be described verbally or represented graphically, as by photographs or computer simulations. The respondent may "bid" different amounts that he or she would be willing to pay in the form of a direct payment, extra taxes, utility bills or some other "payment vehicle." A number of variations on the basic format have been used, but the goal is to use responses to the hypothetical market to estimate the economic value of the environmental quality level (or change in level) represented (Cummings et al. 1986, Rowe and Chestnut 1982). These contingent values have the advantage of providing relatively precise (cardinal) measures of value that are potentially commensurate with other costs and benefits of environmental change.

Contingent valuation and scenic beauty estimation methods were applied in the present study to assess the effects of forest conditions in developed campgrounds on campers' perceptions of the value of their camping experience and of the scenic beauty of the surrounding forest. The present experiment sought tot determine the relationshp between perceived scenic beauty and estimated value of camping experience over a range of forest conditions that typically occurs in developed campgrounds in northern Arizona forests.

METHOD

Study sites representative of northern Arizona forest campground areas were selected to represent a range of overstory and understory characteristics as well as general features such as slope, aspect and habitat type. In conjunction with a bio-physical inventory, the sites were systematically photographed.

Several color prints for each site were mounted on separate pages of a "photo album" which was shown to campers in the context of a personal interview. Each respondent saw the photo pages in one of 6 predetermined random orders. One half of the respondents rated the area represented by each page of prints for scenic beauty. The other half of the respondents provided contingent value estimates of maximum willingness to pay, in the form of total trip expenses, for a hypothetical camping trip to an area with forest characteristics like those represented in the prints. Expense estimates and scenic beauty ratings for each of the forest sites represented in the photo pages were appropriately scaled and aggregated to yield an index of willingness to pay and of scenic beauty, respectively.

Study Areas--The study areas consisted of 20 timber stands and 12 US Forest Service campgrounds, located on four national forests in northern Arizona. The elevation of the study areas ranges from 5,600 ft. to 7,600 ft. The timber stands were all predominately ponderosa pine, with some stands having mixes of gamble oak or juniper. Stands included various mixes of small, intermediate, and mature sawtimber, pole timber and saplings (a more detailed description of the 20 stands is found in Brown and Daniel, 1984).

The 12 campground sites represent a range of forest conditions, including various tree age classes, densities, stories, and species. Most are predominantly occupied by a two-storied ponderosa pine stand. An exception is Ashurst Lake campground, which is located in a mixed stand of one-seed juniper (Juniperus monosperma Sarg.) and ponderosa pine. Each campground has either a lake or stream nearby, and includes a standard set of facilities such as parking spaces, restrooms, drinking water outlets, picnic tables, firepits and grills. The season of use is principally from Memorial Day to Labor Day.

Photographic Representation of Study Areas--In each of the 20 timber stands, 4 color slides were taken at each of 15 randomly located inventory points according to the procedure described by Brown and Daniel (1984). Six of the 60 available slides from each stand were randomly selected to represent the stand to campground respondents. In each of the 12 campgrounds, 30 color slides were taken at randomly selected locations under the constraint that the scenes did not contain people or man-made features, such as lakes, picnic tables, vehicles or tents. The photos showed only the surrounding forest as viewed looking out from the campsites, and thus showed scenes similar in character to those in the photos of the 20 timber stands. Slides from each campground were visually inspected for photographic quality (exposure, focus, etc.) and sets of 6 acceptable slides were randomly selected for presention to campers. One campground was represented by two sets of scenes (12 slides) and another by three sets (18 slides) to provide a preliminary test of the reliability of the photo representation procedure. The other 10 campgrounds were each represented by one set of 6 slides.

Three by five inch prints were made of each selected slide. A total of 35 sets of 6 prints each were produced, one set for each of the 20 timber stands, one for each of 10 campgrounds, 2 for one campground, and 3 for the other campground. The prints of each set wer mounted in a 3 x 2 array on separate pages of a photo album, which was shown to campers.

General Survey Procedure--Direct personal interviews were conducted with campers sampled at each of the campgrounds during the summer of 1985. At one of the campgrounds, Knoll Lake, the water supply failed early in the study, resulting in substantially reduced use and discontinuation of surveys at the site. As a result, the responses obtained at Knoll Lake were dropped from the

study, although responses about the Knoll Lake photo set obtained at other campgrounds were retained. Table 1 lists the 11 retained campgrounds.

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Table 1 about here

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Three trained interviewers visited the campgrounds following a predetermined sampling schedule. Individual campers were approached at their campsites and asked to participate in the interview. Two interviewers operated as a team to survey campers at the Spillway, Christopher Creek and Canyon Point campgrounds during June. This same team then surveyed campers at Kaibab Lake, White Horse Lake (A and B) and Dogtown campgrounds in July. The third interviewer surveyed Ashurst, Pine Grove, Dairy Springs and Rock Crossing campgrounds during both June and July. The assignment of interviewers and sample times were determined by the geographic distribution of the sites and the time and personnel available for the study.

The interview was composed of three sections, (1) an initial set of questions regarding the current camping trip, (2) the scenic beauty or contingent valuation responses to the hypothetical areas represented in the photo albums, and finally (3) some basic demographic questions about the respondent. The initial questions covered items such as the length of stay, number in the party, previous trips to the sample site, other destinations on the current trip, and trip expenses.

At the end of the first section, preceding the photo survey section of the interview, all respondents were asked to estimate their (household) expenses for the trip. Respondents were specifically asked to estimate their party's expenditures for gasoline, food and beverages, and campground and rental fees for the Arizona part of their trip. The three amounts were summed by the

interviewer and divided by the number of days to be spent in Arizona to get a total dollar expenditure per day for the Arizona part of the trip. The daily expenditure was multiplied by the number of days the party would be staying at the campground to obtain a total expenditure per party for the stay at the campground, the Expense TOTal, or ETOT.

After confirming (or correcting) the final calculated ETOT, the respondent was told:

> "We are interested in knowing how much more you (your household) would have been willing to spend on this trip before deciding not to come to this campground-- that is, before deciding to do something else or to stay at home."

The interviewer then asked,

> "How much MORE would you have been willing to spend?"

The sum of ETOT and MORE, then, was taken as the respondent's expressed maximum willingness-to-pay (via incurred expenses) for the current trip to the campground.[1] The interview then proceeded to the photo-based evaluations with half of the respondents following the scenic beauty rating procedure and half following the contingent valuation procedure as described below.

Scenic Beauty Photo-based Survey and Scaling Procedure--Half of the respondents in the survey were asked to rate the scenic beauty of the forest areas depicted in the 35 photo pages. Each respondent first looked through all 35 pages of photos "to get an idea of the types of areas represented" and then assigned a rating to each area shown in the photos using a scale that extended from 1 (low scenic beauty) to 10 (high scenic beauty). Respondents were instructed that they were to rate the areas represented by the photos, not the photos themselves.

Following the interviews, scenic beauty ratings obtained for each respondent were first inspected, and any respondent not recording a rating for each photo set was dropped from the sample. Consistency with other respondents in the appropriate campground sample was also assessed; any respondent producing a correlation with the mean ratings for his/her campground sample that was less than 0.05 was dropped from the sample. The number of respondents dropped for these reasons ranged from 0 in the Rock Crossing sample to 11 (9%) in the Canyon Point sample. The resulting sample sizes are listed in Table 2.

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Table 2 about here

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The scenic beauty ratings of retained respondents were then scaled to Scenic Beauty Estimates (SBEs) using the "by slide" procedure (Hull et al. 1984, Brown and Daniel 1984, Daniel and Boster 1976). This procedure, based on Thurstone's theory of categorical scaling (Torgerson 1958), yields an interval scale measure of perceived scenic beauty. The origin of the SBE scale was determined in this case by the average rating across all 35 photo sets. Each campground sample was scaled independently, so that SBEs were obtained for each photo set for each campground sample.

Contingent Valuation Photo-based Survey and Scaling Procedure -- For the other half of the respondents, variation of the contingent valuation method was used to elicit willingness to pay to camp at the campground where they were sampled given that forest characteristics were as depicted in a page of color prints. The interview process and the adjustments made to the responses were designed to ensure that valid estimates were derived and to provide a contingent valuation measure for the areas represented in the photographs that could be compared to the scenic beauty indices.

Respondents were given a response sheet on which their maximum willingness to pay (sum of ETOT and MORE, obtained as described above) was written and were asked to respond to the following question with regard to each set of photographs:

"On the lines below, please indicate the most you would have been willing to spend on this trip if forest conditions at this campground, all other things being equal, were like the forest areas depicted in the photos."

Respondents first looked through the entire book of photos to get a "preview" of the forest areas represented. They then proceeded to indicate on the response form the maximum expense that they would be willing to incur for a camping trip to a forest area like that depicted in each of the photo sets. The expressed maximum expenses the respondent was willing to incur was used as the basic measure of the recreational value of a trip per party to the campground if forest conditions were as depicted in each of the 35 photo sets.

Any respondent not recording an expense estimate for each photo set was dropped from the sample. Between 2 and 9 respondents were dropped from each of the 11 campground sample groups. The value index for the contingent valuation assessment of the photos was then expressed in dollars as net willingness-to-pay in terms of expenses per individual per day. The value index, CV, was calculated as:

$$CV_{ij} = (MAX_{ij} - ETOT_j) / (D_j * N_j) \qquad (1)$$

where

MAX_{ij} = the maximum expense respondent j was willing to incur for the current trip to the campground if the forest had the appearance depicted in photo-set i;

$ETOT_j$ = on-site expense estimate for respondent j;

D_j = the number of days for respondent j's current

trip;

N_j = the number of people (in the household) on respondent j's current trip.

CV_{ij}, then, was the amount more (or less) per person per day that a respondent estimated his or her household would be willing to spend for their current trip to the campground. Any respondent producing a standard deviation of 0 over the 35 photo set estimates was considered to have "rejected" the CVM procedure and was dropped from the sample.[2] A total of 24 cases (2.9%) were dropped as a result of this rule, leaving the sample sizes listed in Table 2. CV responses were further "trimmed" by elimination of extreme values. Individual CV estimates that were three standard deviations or more above the sample mean CV were dropped from the sample as being "strategic" responses or coding errors. A total of 480 estimates (1.8%) were dropped by this rule. CV_{ij} were then averaged across respondents to yield mean CVs for each photo set (CV_i) for the various respondent groups.

RESULTS

Respondents-- The number of campers interviewed at each site varied depending upon the number of campsites and campers visiting during the survey period. As shown in Table 1, the number of campers interviewed ranged from 75 at Dogtown Reservoir to 220 at Canyon Point.

Inspection of Table 1 reveals considerable similarity among the 11 campground samples. The Ashurst Lake and Rock Crossing samples tended to have shorter stays, about 3.0 days, and the Dairy Springs and Pine Grove samples had the longest stays, about 6.5 days. Canyon Point and Pine Grove respondents tended to be older (about 54 years) and Rock Crossing respondents were younger (about 40 years) than the overall average. These same campground samples also

yielded the fewest and the most first time visitors, respectively about 36% and 63%. For the most part, however, there were few substantial differences between campground samples.

Table 1 also reveals strong similiarity between the scenic beauty rating and contingent valuation samples, as was expected given the random assignment of respondents to the two versions of the survey. In addition, there were no significant differences between the two respondent categories in their estimates of current trip expenses (ETOT) or additional willingness to pay (MORE).

Intra-class reliability coefficients (Ebel, 1951) were computed for the scenic beauty and contingent valuation samples at each campground. These coefficients ranged from 0.83 to 0.98, and all but two were greater than 0.90 (Table 2), indicating that the scenic beauty rating and CV values obtained from similarly drawn samples of recreationists at each of the campgrounds would be expected to be very similar to those reported here.

Reliability of Photo Representations--Intra-class reliability coefficients (Ebel 1951) were computed for the CVM and SBE samples at each campground. These coefficients ranged from 0.83 to 0.98, and all but two were greater than 0.90 (Table 2), indicating that the CV and SB values obtained from ~~other~~ similarly drawn samples of recreationists at each of the campgrounds would be expected to be ~~quite~~ very similar to ~~the~~ these samples reported here.

The 20 timber stands had earlier been evaluated for scenic beauty, offering an opportunity to compare results with the photo-book representation procedure. All 60 slides available for each stand were individually rated for scenic beauty by groups of student volunteers at the University of Arizona (Brown and Daniel 1984). The individual slide SBs were then averaged to yield an overall SB for each stand. Correspondingly, the SBs for the same 20 stands obtained during the campground interviews were averaged across campground samples to yield one SB

for each of the 20 stands. The correlation of the color-slide SBs and the photo-set SBs for the 20 stands was 0.90, indicating both procedures produced very similar relative scenic beauty judgments.

Another check of reliability was provided by the two campgrounds that were represented by more than one photo-set. Pine Grove was represented by two photo-sets and Kaibab Lake by three sets. Comparison of CV and SB values (averaged over the total CVM and SBE samples, respectively) in separate one-way ANOVAs revealed highly significant differences among the 35 photo-sets, $F(34/24004) = 148.32$, $p < .001$, and $F(34/25704) = 253.69$, $p < .001$, respectively. Post-hoc multiple comparisons tests (Winer 1971) were used to assess the differences between the repeated photo representations. The conservative Scheffe test found no significant differences in SBs or CVs between the two photo-sets representing Pine Grove (mean SB = 7.1 and 7.0, CV = 2.0 and 1.6) or among the three Kaibab Lake sets(SB = 6.7, 6.4, and 6.1; CV = 1.7, 0.8, and 0.3). A less conservative Tukey "Wholey Significant Difference" test found the highest and lowest SB/CV of the three Kaibab Lake samples to be significantly different, but neither was different from the middle sample. The two Pine Grove samples were not significantly different for either the SBE or the CVM analysis.

Taken together, the results of these analyses indicate that the representation of the forest surrounding the campgrounds by color photo-sets was successful. Earlier studies in which the 20 stands were represented by 60 color slides each produced the same relative SB values as did the photo-sets of 6 color prints. Though one test found a significant difference between the two most divergent Kaibab photo-sets, there were no substantial differences between multiple photo-set representations for two of the campgrounds.

Campground Sample Comparisons--Scenic beauty rating and CV judgments for the photo sets were very similar between the different campground samples. The mean values across all 35 photo sets shown in Table 2 reveal little difference from one respondent sample to another. Mean scenic beauty ratings ranged from a high of 6.29 for the Rock Crossing sample to a low of 5.61 for the Christopher Creek respondents. The Ashurst Lake campground sample produced the highest average CV, $0.45, and the Christopher Creek sample produced the lowest, $-0.77.

Two-way analyses of variance (with the number of observers in each camp ground group randomly reduced to 35 for all groups) for the scenic beauty rating and CV measures showed that mean responses to the photo sets were not significantly different across campground samples. For scenic beauty ratings, campground was not significant, with $F(10,374) = 1.74$, and the effect of photo-set was again highly significant, with $F(34,12716) = 109.54$, $p < .001$, and explained (eta squared) 23 percent of the variance in ratings. For CV, campground was again not significant, with $F(10,352) = 1.00$, but the effect of photo-set was highly significant, with $F(34,11968) = 81.63$, $p < .001$, and explained 19 percent of the variance in willingness to pay. The two-way interaction, photo-set by campground sample, did prove statistically significant in both analyses, $F(340,12716) = 1.38$, $p < .001$, and $F(340,11968) = 1.50$, $p < .001$ for scenic beauty ratings and CV's, respectively. However, the interaction accounted for only 4% of the variance in each case, indicating that there were not substantive differences in the relative scenic beauty or $\widehat{CV}$ values assigned by the different campground samples.[4]

The inter-correlations among campground samples for scenic beauty and contingent valuation responses to the 35 photographed areas indicates the extent to which the samples agree about the relative value of the areas. The 55 pair-wise correlations between the SBEs of the 11 different respondent groups

range from a low of 0.78 between Rock Crossing and Christopher Creek to a high of 0.97 between White Horse A and B, with a median of 0.92.5 The 55 pair-wise CV correlations range from a low of 0.79 between the Ashurst Lake and the White Horse A samples to a high of 0.96 for the Christopher Creek and White Horse B samples, with a median correlation of 0.93. Even the lowest values indicate high agreement in the relative SBE and CV values, respectively, for the depicted forest conditions. Overall, there is clearly very good agreement between campground samples in both the SBE and the CV values derived for the 35 areas represented in the photo book pages. Further analyses, then, are based on aggregate measures of SBE and CV, with values for each photo set averaged over the 700+ respondents without respect to the campground in which they were sampled.

Comparison of SBE and CV--The principal objective of the present study was to determine the relationship between perceived scenic beauty of the forest and the value of forest recreation experience. Figure 1 presents a plot of the grand mean SBE against the grand mean CV for each of the 35 photo-page areas. The relationship is strongly positive; the simple correlation coefficient is 0.96, indicating a nearly perfect relationship. Inspection of the scatter plot in Figure 1 reveals that the consistency between SBE and CV values is uniform over the entire range of both variables; as the judged scenic beauty of the forest increases, campers' estimated willingness to pay (in expenses) for a camping trip to the area increases proportionately.

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Figure 1 about here.

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Figure 1 indicates a range in net willingness to pay of ~~$6.50~~ 7.00 per person per day over the obtained range of SBE values (~~$19~~ 20.00 on a household per day

basis). That is, campers in general indicated a considerable willingness to pay for improved scenic beauty of the surrounding forest, when assessed in the context of constant levels of all other features of the camping experience.

DISCUSSION

Of principal interest in this study are the contingent valuation and scenic beauty responses about 35 forest areas depicted by sets of color photographs. Those responses were obtained from campers sampled at 11 Forest Service campgrounds in northern Arizona. One half of the sample at each campground responded to scenic beauty questions about the photos and the other half responded to contingent valuation questions. Respondents were told that the photo sets represented alternative forest conditions for campgrounds similar to the campground where they were.

The responses were very consistent across campground samples, as indicated by the inter-correlations among the CV responses and among the SBE responses of the 11 sample groups. Additional evidence of the consistency of the results is the high correlation between SBEs of campers' responses to 20 of the photo sets and SBEs of student volunteers to a much larger set of color slides of those same 20 areas. Furthermore, students in a classroom setting, who had no personal involvement with the campgrounds, rated the forest scenes of the campgrounds similarly to the campers. The consistency of the contingent valuation responses is notable because it holds across 35 levels of a multidimensional stimulus. Previous contingent valuation studies have typically obtained responses to at most 4 or 5 levels (Cummings et al. 1986).

The principal finding of this study is that the correlation between mean SBE and mean additional willingness to pay (CV) for the areas depicted in the 35 photo sets was nearly unitary (see Figure 1). Both response models elicited the

same preference ordering. That is, subject to a linear transformation, the scenic beauty and contingent valuation measures were essentially identical for the forest stimuli used in the study. This indicates that scenic beauty and contingent valuation respondents were both sensitive to the same variations in forest characteristics--that the forest characteristics that influence perceived scenic beauty also influence perceived value of camping, all else equal.

The strong linear relationship between CV and SBE has several implications of interest. First, campers' expressed willingness to pay for forest characteristics, other features of the campground being equal, is closely related to scenic beauty, as indicated in Figure 1. Thus, models of forest scenic beauty, developed from regressing measures of perceived scenic beauty on measures of forest bio-physical characteristics (e.g., Buhyoff et al. 1982, Schroeder and Daniel 1981, Hull and Buhyoff 1986, Brown and Daniel 1986,) should indicate forest features that are important to the value of forest camping experiences. For ponderosa pine forests similar to those of this study, scenic beauty models indicate that large trees, lush low ground cover, openness in the stand, and the lack of downed wood all contribute to improved scenic beauty. These same features, then ... sites ...management.

It must be acknowledged, however, that the highly significant linear relationship found between SBE and CV is based on responses to sets of photos that differed only on a subset of the factors that might be expected to affect camping quality. The photo sets differed only in terms of the characteristics of the surrounding forest, and the contingent valuation respondents were instructed to indicate willingness to pay assuming everything about the campgrounds except the forest characteristics remained the same as in the campground where they were interviewed. The close correspondence between perceived scenic beauty and the value of camping might not hold if other

campground features (e.g., facilities, crowding) were varied in addition to forest characteristics. It is possible that variations in these other features would be of sufficient importance to campers that the sensitivity to forest characteristics found in this photo-based assessment would not be found, or would be different. Still, these data do support the conclusion that scenic beauty of the surrounding forest makes an important contribution to the value of recreators' camping experience. The relative importance of forest scenic beauty as compared to other features of campgrounds, and the positive interaction of forest characteristics with other social and physical characteristics of campgrounds should be addressed in future research.

It is also worth noting that the close correspondence between SBE and CV found at campgrounds might not be found for some other forest recreation activities. For example, Daniel and Boster (1976) found evidence that hunters' judgments of scenic beauty differed somewhat from the general publics, with hunters preferring forest conditions that favored game habitat.

CONCLUSIONS

Three conclusions seem warranted based on this research. First, both the scenic beauty and willingness to pay measures appear to be very reliable. This is supported by the within group reliability coefficient and by the agreement among different respondent samples about the relative scenic beauty or contingent value of the 35 photographed areas. Second, the very close correspondence between the two measures indicates that perceived scenic beauty of forest environments, at least in ponderosa pine, is closely related to perceived value of those environments for camping, all else (i.e., other campground characteristics) equal. Third, the importance of the "all else

equal" qualification, and the corresponding importance of various other features of campgrounds relative to scenic beauty and the monetary value of camping, should be investigated in future research.

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FOOTNOTES

[1] It is a "compensating variation" measure because the initial and reference levels of utility are the pretrip level (Brookshire et al. 1980, Just et al. 1982).

[2] It is possible that a person reporting identical estimates of willingness to pay for all 35 photos was indicating that he/she found no differences among the 35 different conditions, or at least assigned no monetary value to the differences. In any case, as reported below (footnote 5), removing these respondents did not significantly affect the results.

[3] The photo-based estimates of both CV and SBE were consistently lower than the estimates for the same campground areas when made on-site for the current trip. The relationships between photo-based evaluations and on-site evaluations are complex, and have been addressed in detail in a companion paper (Brown et al. under review). The focus of the present paper is on a comparison of photo-based CV and SBE values.

[4] Interestingly, it was the Ashurst Lake campground sample that yielded the greatest departure from the pattern of the other campground samples; Ashurst campers gave higher SBEs and higher CVs for the Ashurst photos. Because the Ashurst campground was primarily juniper forest with a few ponderosa pine, it was the most distinguishable from the other sites assessed. The Ashurst sample, unlike the others, almost certainly recognized the photos of their campground, and apparently elevated their assessments of those photos.

5 In two additional experiments, ratings were obtained in a classroom setting from involvement with the campgrounds. In one experiment, the notebooks of color prints that were used in the campground interviews were rated by 78 students of introductory psychology calsses at the University of Arizona (UA) and by 21 forestry graduate students at Norther Arizona University (NAU). The students'

SBEs correlated 0.83 (UA) and 0.89 (NAU) with camper's SBEp's (the UA and NAU SBEs correlated 0.87 with each other). In the other experiment, 35 sets of 6 color clides corresponding to the 6 prints found on each page of the notebooks were rated by 33 UA undergraduates and by 44 NAU undergraduates. Respondents provided one rating for each set of 6 sequantially projected slides, using methods described by Brown and Daniel(1984). Students' SBEs of the slide sets correlated 0.79 (UA) and 0.84 (NAU) with the campers' SBEp's.

6 The procedures used to trim scenic beauty and contingent valuation responses were employed to arrive at what we consider to be the best estimates of SBE and CV. However, it should be mentioned that the trimming did not significantly affect the reported relationship between SBE and CV. With all responses included, the correlation was 0.9x.

Table 1. Interview sites and characteristics of respondents.

Campground	National Forest[a]	Respondent Type	Sample Size	% Male	Mean Age (years)	Mean Income[b] ($1000)	Mean Stay (days)	Mean Number of People	% First Time
Ashurst Lake	CO	SBE	60	44	43	32	2.6	3.0	49
		CVM	62	55	46	31	3.5	2.7	48
Canyon Point	AP	SBE	108	41	54	37	5.2	2.4	34
		CVM	112	57	54	37	5.2	2.4	36
Chistopher Creek	TO	SBE	106	44	41	31	3.3	3.0	43
		CVM	106	48	40	32	3.2	3.1	43
Dairy Springs	CO	SBE	59	49	46	31	6.7	3.0	54
		CVM	62	47	47	33	6.4	3.1	55
Dogtown Reservior	KA	SBE	39	42	46	36	3.2	2.8	42
		CVM	36	53	47	37	3.2	2.9	47
Kaibab Lake	KA	SBE	81	44	43	33	3.3	3.0	58
		CVM	80	48	44	33	3.5	3.2	55
Pine Grove	CO	SBE	60	48	53	28	6.7	2.4	32
		CVM	63	57	55	29	6.3	2.4	39
Rock Crossing	CO	SBE	51	40	39	35	3.1	2.8	62
		CVM	49	49	40	38	2.9	2.9	65
Spillway	AP	SBE	91	48	42	33	4.0	3.1	46
		CVM	91	54	42	35	3.7	3.2	41
Whitehorse A	KA	SBE	53	50	43	29	3.5	3.2	42
		CVM	55	47	42	31	3.6	3.3	39
Whitehorse B	KA	SBE	102	42	43	33	3.9	2.9	40
		CVM	102	56	43	34	3.9	2.9	40

[a]CO = Coconino, AP = Apache-Stigreaves, TO = Tonto, KA = Kaibab
[b]Mean of internal midpoints for each respondent.

Table 2. Trimmed sample size, reliability coefficient, and mean scenic beauty rating and CV values for 11 campground samples.

	Contingent Valuation Sample			Scenic Beauty Sample		
Campground	Sample size	IRC[a]	Mean[b] CV ($)	Sample size	IRC[a]	Mean[b] Scenic Beauty Rating
Ashurst Lake	45	0.83	0.45	54	0.92	5.83
Canyon Point	100	0.96	0.19	97	0.98	5.69
Christopher Creek	86	0.95	-0.77	101	0.98	5.61
Dairy Springs	57	0.91	-0.21	56	0.95	6.08
Dogtown Reservoir	33	0.91	0.11	38	0.93	6.10
Kaibab Lake	70	0.93	-0.22	79	0.97	5.94
Pine Grove	52	0.89	-0.58	53	0.96	6.18
Rock Crossing	46	0.92	0.05	51	0.94	6.29
Spillway	80	0.94	-0.65	82	0.97	5.67
Whitehorse A	46	0.92	-0.40	50	0.96	6.19
Whitehorse B	92	0.96	-0.03	96	0.98	5.76
Total	707			757		

[a] Intra-class reliability coefficient (Ebel 1951).

[b] Mean response across 35 photo sets.

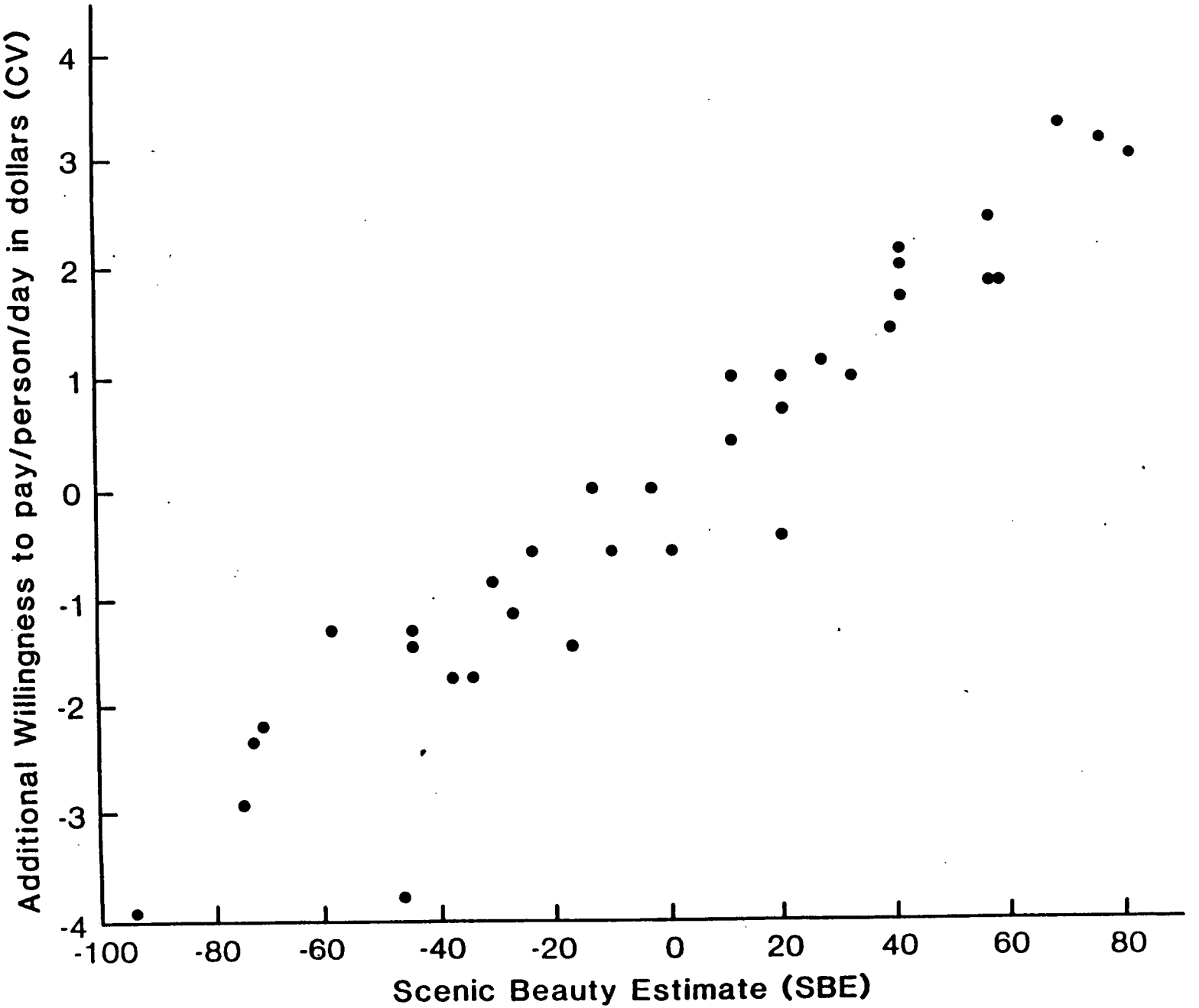

Figure 1 Scenic beauty estimate (SBE) verses willingness to pay (CV).

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Recreation Participation and the Validity of Photo-based Preference Judgments

by

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Abstract

Campers interviewed onsite consistently preferred the forest around the campground they were visiting to the same forest area represented by color photos. This preference for directly observed over photographically represented scenes was found in ratings and rankings of forest scenic beauty, and in judgments of willingness-to-pay to camp in forested areas. Several possible explanations for these findings are discussed. Prior choice and active participation by respondents in camping activities may have played an important role in preference judgments.

KEYWORDS: Recreation, validity, scenic beauty, contingent valuation, photographic representation

Introduction

The use of photographs to represent environmental conditions is a common procedure in evaluations of public preference. The procedure has numerous advantages. First, pictures can depict most environmental situations more accurately than mere verbal descriptions. Second, use of photos as surrogates avoids the costly and time-consuming task of transporting respondents to the scenes. Third, photos can be altered, allowing carefully controlled comparisons among alternative conditions. These advantages have led to the extensive use of photographs in studies of environmental perception (e.g., Shafer, Hamilton, & Schmidt, 1969; Peterson, 1969; Zube, Pitt, & Anderson, 1975; Daniel & Boster, 1976; Buhyoff & Leuschner, 1979) and in contingent valuation studies (e.g., Randall, Ives, & Eastman, 1974; Rowe, d'Arge, & Brookshire, 1980; Daubert & Young, 1981).

Photo-based preference judgments have been shown in numerous studies to be highly reliable and of consistent validity. In particular, group-to-group reliability of rating judgments for groups drawn from the same population is generally high, and test-retest reliability is also generally high (e.g., Daniel & Boster, 1976; Jackson & Hudman, 1978; Stewart, Middleton, Downton, & Ely, 1984; Brown & Daniel, 1984; Schroeder, 1984). And, studies have repeatedly shown that judgments from photos are highly correlated with direct

(onsite) judgments of the same areas (Boster & Daniel, 1972; Shafer & Richards, 1974; Daniel & Boster, 1976; Shuttleworth, 1980; Kellomaki & Savolainen, 1984; Stewart et al., 1984; Shelby & Harris, 1985).

Previous studies comparing direct and photo-based assessments recruited people who were taken to numerous areas selected by the investigator and who provided their judgments of each (a "touring panel"). The judgments obtained in this manner were then compared with the judgments of photographs of the areas obtained from the same or different observers. By recruiting observers who systematically travel to and judge each area onsite, such studies tend to remove the observers from any personal attachment to the areas, or at least from more attachment to one area than to another area, and thus avoid the issue of whether actual use of and personal involvement at the areas would affect the judgments.

In the study reported here, campers were contacted at developed campgrounds that they had chosen themselves for recreation, and asked for their judgments about the site (their "direct" judgment). That is, respondents who had self-selected their site and were actively participating in recreation there provided direct judgments. These same campers provided judgments for 35 areas represented by color photographs (their "photo-based" judgements). The campgrounds where interviews took place were among the 35 photographed areas. The

direct judgments were compared with the photo-based judgments for the same areas, under the expectation that the photo-based judgments would provide valid indications of the direct judgments.

Direct and photo-based judgments were compared in three experiments. The first experiment obtained ratings of the scenic beauty of the surrounding forest from campers at 11 campgrounds. The second required rankings of scenic beauty from campers at 6 campgrounds. The third obtained estimates of willingness to pay from campers at 11 campgrounds.[1] In the sections that follow, the study sites are described, the methods and results of the three experiments are presented, and then the results of all three are discussed.

Study Areas

The 11 forested campgrounds[2] where personal interviews were conducted for this study are located in north-central Arizona. Each campground is located near a man-made lake. Ponderosa pine is the predominate overstory species at each campground, but some of the campgrounds also have other tree species present, such as pinyon pine, Utah juniper, Douglas-fir, and Gambel oak. The forests in which the campgrounds are located contained a range of scenic conditions; but, they did not manifest harvest effects (e.g., stumps and slash) and thus did not include the least attractive possible conditions. Each campground is organized into campsites that contain a picnic table,

grill, and place for a vehicle and tent. All campgrounds charged a daily fee, which ranged from $3 to $7 dollars across the 11 campgrounds.

Shortly before interviewing began in June of 1985, four color photographs were taken in each campground at each of 15 randomly selected locations, under the constraint that the scenes should not contain people or man-made features such as lakes, picnic tables, vehicles, and tents. The photos primarily showed the characteristics of the surrounding forest as viewed looking out from the campsites. In August of 1985, shortly after the interviews were completed, photos were retaken from all of the original photo points for use later in checking whether the scenic character of the sites had changed during the interview season.

During personal interviews at the campgrounds, judgments were obtained for a subset of the photos of the campgrounds, and also for photos of 20 other ponderosa pine stands located on the Coconino National Forest. Photos of these stands were taken in 1979 as part of earlier studies (Brown & Daniel, 1984, 1986). Four photos were taken in each stand at each of 15 randomly selected inventory points, according to the procedure described by Brown and Daniel (1984). These stands were similar to the campgrounds, although many of the stands were of generally lower scenic beauty than the campgrounds because of the presence in the stands of more downed wood and small trees.

Scenic Beauty Rating

In the scenic beauty rating experiment, photo-based ratings were compared to direct ratings in terms of both relative and absolute differences. It was hypothesized that the photo-based rating would correlate highly with and be similar in magnitude to the direct ratings.

Methods

Heads of households were interviewed at each of the 11 campgrounds. The interviews were allocated among campsites at the campgrounds so that individual sites were not oversampled. Each interview took about 30 minutes to complete. A total of 727 interviews were completed by three interviewers. The number of interviews completed at each campground is listed in Table 1.

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Table 1 about here

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The interviews began with questions about the overall nature of the trip (e.g., trip route, length of stay, other stops, camping history) and about trip expenses and willingness to pay for camping. Next, respondents were asked to provide a scenic beauty rating for each of 35 forest areas depicted on photos, and then for the forest surrounding the campground where the interview took place. The interviews concluded with socio-demographic questions (e.g., age, income, zip code).

Each of the 35 photographed areas was depicted by a set of six 3x5-inch color prints, randomly selected from among the photos available for each area. Each set of prints was arranged on a page of a looseleaf notebook. The 35 areas represented the campgrounds in which the interviews took place, plus other ponderosa pine stands from an area on the Coconino National Forest, as mentioned in the previous section.[3] Six notebooks, each with the 35 pages arranged in a unique random order, were alternated in the interviews.

The photo-based questions asked respondents to "assign a scenic beauty rating to each forest area," where 1 = "very low scenic beauty" and 10 = "very high scenic beauty." Respondents first looked through all 35 pages of photos to "get an idea of the types of areas represented," and then began rating them. Respondents were instructed to rate the areas represented by the photos, not the photos themselves.

After all 35 photographed areas were rated for scenic beauty, respondents were asked to "rate the scenic beauty of the forest area around this campground." It was made clear that this direct rating was to apply to the entire campground, and not just the immediate area around their campsite. The 35 photo-based ratings were expected to provide a basis for the direct rating, such that each respondent's direct rating would be reported on the same subjective rating scale as the previous 35 photo-based ratings.

The design of the survey made it unlikely that many respondents recognized their specific campground among the 35 photographed areas. First, respondents were not told that their campground was represented among the photos. Second, the specific interview locations seldom corresponded with the photo point of a photograph included in the presentation, so that respondents were rarely able to match a photo with the scene from their campsite. Third, more than one of the 35 photo sets depicted the general nature of the forest characteristics of most campgrounds, making it difficult for respondents to unequivocally recognize "their" campground among the photos. However, it was expected that the difficulty in recognizing a specific campground among the photos would not hinder respondents from indicating their preferences for campground forest characteristics Zajonc, 1980).

Any respondent not recording a rating for every stimulus was dropped from the sample. Thirty-six respondents were dropped for this reason. In addition, to allow computation of Z-scores, seven respondents were dropped because they recorded the same rating for all 36 stimuli. In all, the total sample was reduced by 43.

Scenic beauty rating responses were combined across respondents to yield values for the direct judgments and for each of the 35 photo-based judgments. Two scaling methods were used, simple means and standardized scores. For each of the 11 campground samples, a simple mean rating was computed for the direct rating (Ro) and for

each of the 35 photographically represented areas (Rp). In addition, mean photo-based ratings of each campground were computed across the full set (i.e., all campground samples combined) of scenic beauty interviews (Rp').

A mean Z-score for each stimulus was computed by converting each rating to a Z-score and then averaging the Z-scores across the appropriate sample. Each Z-score was computed using the standard formula, as follows:

$$Z_{ij} = (R_{ij} - R_i)/S_i$$

where Z_{ij} = Z-score of respondent i for stimulus j

R_{ij} = rating of respondent i for stimulus j

R_i = mean rating of respondent i

S_i = standard deviation of ratings by respondent i.

The Z-score transformation expresses each rating, in standard deviation units, as a difference from the average rating that the observer assigned to the stimuli, thereby adjusting the responses to the extent that different respondents tended to use different portions of the rating scale for recording their judgments. The onsite values for each campground (Zo) were computed by averaging the onsite Z-scores of the respondents interviewed at the campground. The values for each photo page (Zp') were computed by averaging the photo-based Z-scores of all respondents.

Results

Each of the 11 campground samples provided internally consistent rating responses to the photos. Group-to-group reliability (Ebel, 1951) for the 11 samples ranged from 0.92 to 0.98, with a median of 0.96, indicating for each sample that other groups of individuals drawn from the same population would be expected to report very similar mean ratings. Furthermore, the 11 samples were highly consistent in their ratings of the photos; among all possible pairs of the 11 samples, Pearson correlations among mean ratings of the 35 photos (Rp) ranged from 0.85 to 0.99, with a median of 0.94, indicating that the 11 observer groups differed little in their opinions of the relative scenic quality of the photographed scenes.[4]

The means of the photo-based ratings of a campground obtained from respondents at that campground (Rp) were very similar to the mean ratings that respondents at all other campgrounds assigned to those photos. Only for Ashurst Lake were the mean ratings significantly different (two-tailed t-tests at 0.01 probability level). Ashurst Lake respondents found the photos of their area more attractive than did the combined sample of respondents from the other 10 campgrounds. Interestingly, Ashurst Lake is somewhat unique in its vegetation, containing more juniper than is found at the other campgrounds.

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Insert Table 2 about here

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Of principal interest is the comparison of onsite ratings to photo-based ratings obtained at the same campground. Mean direct (Ro) and corresponding photo-based (Rp) ratings for each of the 11 campgrounds are listed in Table 2 and shown in Figure 1. Each point in the figure indicates the mean rating of one campground obtained from respondents interviewed at that campground. For example, the mean rating of respondents at Spillway of the photos of their campground is 5.55 and their direct rating of the forest around the campground is 8.14.

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Insert Figure 1 about here

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As depicted in Figure 1, the direct scenic beauty ratings of all campground samples were all substantially above their corresponding photo-based ratings. Individual t-tests for each sample showed that the direct means (Ro) were all significantly higher than the photo-based means of the same campground (Rp) (various n, two-tailed tests, $p < 0.01$). And, this result was essentially the same for several important subsets of the sample. That is, individual t-tests showed significantly higher direct than photo-based mean ratings whether or not respondents (1) were at their first choice as a place to camp on that trip, (2) were on single destination trips, or (3) had previously camped there. And the result holds if the sample-wide

photo-based measure (Rp') rather than Rp is compared with Ro, and if the comparison is in terms of Z-scores (Table 2) rather than scenic beauty ratings.

Furthermore, the mean direct ratings were not just greater than the mean photo-based ratings of the same campground--they were also greater than the mean ratings assigned to the photos of any of the 11 campgrounds. That is, at all campgrounds, the highest photo-based mean rating was lower than the mean direct rating. While not all of these differences are significant, most are. Student-Newman-Keuls multiple range tests of each campground sample, at the 0.05 probability level, showed that at 4 of the campgrounds, the direct mean was significantly greater than all 11 photo-based means; at 2 campgrounds, the direct mean was significantly greater than 10 of the 11 photo-based means; and at 3 of the campgrounds the direct mean was significantly greater than 9 of the photo-based means. Only at Knoll Lake, where the sample size was limited, and at Ashurst Lake, the campground assigned the lowest direct rating, was the mean direct rating not significantly higher than the mean photo-based rating of at least 9 of the 11 campgrounds.

The direct onsite ratings were unusually high for scenic beauty ratings of ponderosa pine scenes. Mean direct ratings ranged from 7.2 to 8.5, and were at least 7.9 for 10 of the 11 campgrounds. Across the 11 campground samples, 27% of the respondents assigned a direct rating of 10, and 70% assigned a direct rating of 8 or higher. This

is in contrast to previous studies; in over 100 slide presentations of Arizona ponderosa pine scenes to public groups in the past 10 years, each of which involved rating 100 or more slides (Daniel & Boster, 1976; Schroeder & Daniel, 1981; Brown & Daniel, 1984, 1986), and in two experiments where observers were transported to numerous ponderosa pine sites and asked for their direct onsite ratings (Boster & Daniel, 1972; Daniel & Boster, 1976), mean ratings above 8.0 were very rare.

It should be clear that the very high direct scenic beauty ratings do not necessarily imply that onsite ponderosa pine scenes in campgrounds are the best of all possible forest scenes. The direct ratings must be considered in relation to the previously obtained photo-based ratings. Once the basis for assigning rating values was set by the 35 photo-based ratings, respondents were apparently forced to the top of the 10-point scale for indicating their perception of the scenic beauty of the area they had chosen for recreation.

While it is apparent that the photo-based ratings and Z-scores were consistently and significantly below their corresponding direct measures, the degree of relative correspondence between direct and photo-based scenic beauty is less obvious. One indication of that correspondence is the correlation between direct and photo-based scenic beauty across the 11 campgrounds. In terms of mean ratings (Ro verses Rp', Table 2), the correlation across the campgrounds is 0.76 ($n = 11$, one-tailed test, $p < 0.01$), while in terms of mean Z-scores

(Zo versus Zp', Table 2), the correlation is 0.86 (n = 11, one-tailed test, $p < 0.001$).[5] Thus, there is some evidence that the photo-based scenic beauty measure provides a reasonably good indication of relative onsite scenic beauty.[6]

Scenic Beauty Ranking

The higher direct scenic beauty ratings, compared to the photo-based ratings, in 1985 interviews led us to suspect that the direct ratings were not based on the same criteria as those used to rate the photos. Rather, it seemed that respondents may have switched to a new frame of reference for the direct rating so that the photo-based and direct ratings were not comparable. With this possibility in mind, a ranking study was designed. It was hoped that the ranking task, which requires comparative judgments, would make it difficult for respondents to use two different sets of criteria in judging the scenic beauty depicted in the photos and in the direct scenes.

This survey was conducted during the summer of 1986, and was confined to 6 of the original 11 campgrounds. The six campgrounds depicted the full range of scenic beauty found among the original 11. The objective was to compare direct and photo-based ranks for the 6 campgrounds under the hypothesis that the direct ranks would not be different from the corresponding photo-based ranks.

Methods

The same color prints that were used to depict the 6 campgrounds in the 1985 rating survey were used for the rank order study. For each campground, the 6 prints were arranged on a cardboard sheet just as they had been arranged on a page of the looseleaf notebook in the previous survey. Respondents were asked, by one of the interviewers who had participated in the 1985 survey, to place the 6 sheets of photos in rank order from low to high scenic beauty. The sheets were placed on an available horizontal surface, which was typically a picnic table. Once respondents were comfortable with their rankings, they were given a blank card and asked to place it among the ranked photos to represent the relative position of the scenic beauty of the forest around the campground where they were. The rankings were then recorded by the interviewer. The interviews took about 10 minutes. A total of 189 interviews were completed (Table 1). All completed interviews were usable.

Scenic beauty ranks were summarized for each campground separately, in two ways. First, the mean rank of each stimulus was computed. Second, the ranks were scaled based on Thurstone's law of comparative judgment (Torgerson, 1958) to yield a mean Z-score for each stimulus.

Results

As with the rating task of the previous summer, there was good agreement across campground samples about the relative scenic beauty of the photo sets. In terms of mean ranks, campers from all 6 campgrounds ranked the 6 photo sets in the same order, with the minor exception of the Pine Grove and Whitehorse A samples reversing the mean rank of Pine Grove and Kaibab campgrounds as compared with the other 4 samples (Table 3). Also, group-to-group reliabilities for the photo-based mean rankings of the 6 samples ranged from 0.95 to 0.98. Furthermore, the overall ranking (Table 3) was identical to the ordering of the mean ratings obtained from all respondents in 1985 (Table 2).

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Insert Table 3 about here

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The results of the ranking task are nearly as striking as the rating results. From 20% (at Ashurst Lake) to 70% (at Pine Grove) of the individual respondents ranked the direct scenes of their campground above any of the photographed areas. On average, respondents at all 6 campgrounds ranked the scenic beauty of the direct scenes above the scenic beauty of their campground depicted in photographs (Figure 2).

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Insert Figure 2 about here

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Individual two-tailed t-tests for each campground sample showed that the mean ranks of the direct scenes were all significantly lower than the photo-based means at the 0.01 probability level. Furthermore, at all but Ashurst Lake, respondents on average ranked their direct scenes equal to or more scenic than any photographed scenes (Table 3). In other words, respondents ranked the scenic beauty of the direct scenes at their campground above the scenic beauty shown in photos of areas that, from photo-based responses, were consistently perceived to be higher in scenic beauty than their campground. Only at Ashurst Lake, which was consistently perceived to be lowest in scenic beauty among the 6 campgrounds sampled (76% of the respondents ranked the photographs of Ashurst Lake below all others), was the onsite area not ranked above all photographed areas. These results were essentially the same when ranks were scaled to Z-scores. Thus, the results suggest that the rating results obtained earlier were not simply an artifact of the rating scale procedure.

Contingent Valuation

In 1985, in addition to the scenic beauty rating survey, other campers at each of the 11 campgrounds were interviewed using a contingent valuation survey instrument. Interviewers alternated

between the scenic beauty rating and contingent valuation instruments, so that each instrument was administered to half of the total number of respondents. A total of 727 heads of households were interviewed using the contingent valuation instrument (Table 1). The direct and photo-based willingness-to-pay responses of this survey were compared under the hypothesis that they would not differ in magnitude.[7]

Methods

Following questions about the overall nature of the trip, respondents were asked about their household's expenditures for gas, food and beverages, and campground and rental fees for the current trip. The campers were then asked how much more they "would have been willing to spend on this trip before deciding not to come to this campground." The sum of expenditures and additional willingness to pay is a compensating variation measure of the household's maximum willingness to pay for the trip to the campground (Brookshire, Randall, & Stoll, 1980).

Next, the interviewers presented the same notebooks of color prints that were used in the scenic beauty rating survey. Respondents were reminded of the maximum that they said they would be willing to spend to camp at the campground, and then asked to indicate for each of the 35 areas in the photos "the most you would have been willing to spend on this trip if forest conditions at this campground (all other things being equal) were like the forest areas depicted in the photos."

The willingness-to-pay index was expressed as willingness to pay per person per day (WTP), computed for each respondent as

$$WTP = T / (P * D)$$

where T = total willingness to pay, including expenses

P = number of people in the household

D = number of days at the site.

Mean onsite and photo-based WTP per campground area were then computed for each campground sample to allow comparisons across campgrounds.

Results

As with the scenic beauty ratings, there was general agreement among the 11 samples about the relative value of the areas depicted in the photos. Among all possible pairs of the 11 campground samples, the correlations of mean total willingness to pay per person per day (WTP) for the conditions represented by the 35 photos ranged from 0.77 to 0.98, with a median of 0.93.

At all 11 campgrounds, mean direct WTP exceeded photo-based WTP. At 10 of the 11, this difference was significant at the 0.01 level (two-tailed t-tests). Mean WTP responses are listed in Table 4 and plotted in Figure 3. This finding, of greater direct than photo-based willingness to pay, was also found when willingness to pay was scaled in terms of total trip willingness to pay (not on a per-person per-day basis) and in terms of willingness to pay above expenses.

- -

Insert Table 4 about here

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Furthermore, t-tests of subsamples showed that the conclusion held whether or not respondents (1) were at their first choice as a place to camp on that trip, (2) were only camping at that campground during their trip, and (3) had previously camped there.

- -

Insert Figure 3 about here

- -

Unlike the scenic beauty rating results, mean photo-based willingness to pay responses for several campgrounds were greater than direct responses for other campgrounds. For example, photo-based WTP for Whitehorse B ($17.41) was greater than direct WTP of four campgrounds. However, the contingent valuation results still show a pervasive tendency for photo-based responses to underestimate direct responses of campers interviewed while participating at their chosen site.

Discussion

Campers' direct ratings and ranks of forest areas were consistently higher than ratings and ranks of the same areas represented by photographs. Campers consistently expressed greater willingness to pay to camp when estimates were based on directly perceived conditions at the chosen campground than when the campground was represented by photos. Furthermore, to a greater extent in the scenic beauty responses, and to a lesser extent in the willingness-

to-pay responses, respondents indicated a preference for their actual area over any of the areas represented in photos. This result was obtained even when photos depicted areas that were consistently preferred in photo-based judgments to those of the area where the interview took place. These results are unexpected and appear to be inconsistent with other environmental preference studies that tested the use of photos as proxies for forest areas.

It is useful to first consider some of the more obvious potential explanations of our results. One explanation is that the photos used in this study did not accurately depict the forest seen by respondents. This explanation has four possibilities. One possibility is that the photos did not adequately depict the areas because of poor photography or differences in the scenes between the time the photos were taken and the time of the interviews. However, in fact, the photo quality was good, and the respondents were asked to focus on the scenes depicted in the photos and not on the quality of the photography. The trees were nearly all conifers which did not change perceptibly between the time the photos were taken and the time the interviews were completed. The only possible change was in groundcover, which increased somewhat during the summer, but judgments of slides taken in early summer compared to judgments of late summer slides did not indicate a systematic increase, or decrease, in scenic quality. Furthermore, examination of the 1985 survey results does not show any increase in direct preference with increase in time since the photos were taken.

A second possibility is that the photo sample was biased, selecting on average scenes that were of below average scenic beauty. However, the photo sample was obtained in a stratified random fashion, and each campground was represented by at least six photos. There were some constraints on photo selection in order to avoid man-made features, but we do not believe that the samples of the campgrounds were biased.

The third possibility was that the interview locations were biased, selecting on average sites that were of above average scenic beauty. However, respondents were instructed to consider the whole campground, not just the forest around their site, and in any case the interviews occurred at many sites in each campground and by design individual sites were not oversampled.

The fourth possible reason for photos not accurately depicting the actual forest scenes is that photos, recreation participation aside, are simply not as attractive as the real surroundings--that, for example, respondents compared the actual scenes with the photos rather than with the forest areas depicted in the photos. While this could have happened in this study, it is unlikely for two reasons. First, respondents were instructed to consider the areas represented by the photos, rather than the photos themselves. Second, numerous photo validity studies (several are cited in the introduction) have found that photos in general provide accurate representations. Indeed, two of these studies (Boster & Daniel, 1972; Daniel & Boster,

1976) were done in ponderosa pine areas very similar to those used in this study and found no discrepancy between onsite and photo-based judgments.

Another possible explanation for the results is that respondents did not comply with the instruction to focus in their direct judgment only on the forest characteristics. Rather, they may have also considered lakes, vehicles, facilities, people, etc., which could have consistently elevated their onsite judgment relative to the photo-based judgments. There is no way to know for sure whether subjects were able to follow the instruction and ignore the other things in the direct scene. However, this explanation is not totally satisfying, for two reasons. First, inclusion of a lake (a preferred scenic feature in outdoor environments; Zube, Pitt, & Anderson, 1975, p. 152) in the view from the campsites does not appear to have significantly affected the results. Lakes were visible from some of the campsites in 6 of the 11 campgrounds, but the group of campgrounds with the largest difference between direct and photo-based judgments included campgrounds both with and without views of a lake. Second, there is no evidence from other studies that man-made features improve the scenic beauty of natural settings. Indeed, most studies show that man-made features tend to depress aesthetic preferences (Ulrich, 1983). Of course, such studies may not apply to recreation where man-made features are an integral part of the experience, as picnic tables, vehicles, etc., are at a developed campground. Such features

might be considered sufficiently "congruent" (Wohlwill & Harris, 1980) in the context of developed camping that they do not depress, or perhaps even enhance, esthetic preferences. Thus, we cannot completely dismiss this explanation of the results.

The remaining possible explanations of the results revolve around the fact that we sampled only campers actively involved in recreation at sites that they had selected. Although numerous studies have shown that photo-based judgments and judgments of actual areas differ little, all those studies systematically asked each subject to view and evaluate a number of areas. In each case, subjects were recruited for a "touring panel" that visited and judged areas one by one. In other words, they were given a comparative task and did not have a personal stake in any of the areas. The subjects of the current study were given a comparative task regarding the photos, but directly judged one area, the area they had chosen for their recreation activity.

It is reasonable to expect that campers would, if possible, choose the area with the characteristics that they prefer. In fact, 88% of the respondents reported that the campground where they were was their first choice for that portion of their trip (although 42% of those had never been there before). Such "self-selection" of preferred characteristics could explain the strong preference for the forest surrounding the chosen campground that each sample indicated in its direct judgments. However, if preference for forest characteristics played a large part in the direct judgments, we would

also expect those same preferences to be reflected in judgments of the photos. But respondents did not in general prefer the photos of their chosen campground over photos of other areas. With the exception of the Ashurst Lake respondents in the scenic beauty rating experiment, respondents at all campgrounds agreed about the relative scenic beauty of the forest areas depicted in the photographs. The fact that direct and photo-based judgments of the same areas differed suggests that forest scenic beauty was not a major factor in campground choice, and that self-selection based on forest characteristics is not a major reason for the difference between direct and photo-based judgments found in this study.

The theory of cognitive dissonance (Festinger, 1957; Aronson, 1984) suggests that people will alter their beliefs to achieve consistency with their choices. Similar theory suggests that people are motivated to appear to others as consistent (Abelson, 1983). These theories suggest that, since our respondents had committed themselves to their campground choice, they perhaps had an interest in thinking, or at least having others think, that their choice was a wise one. In addition, dissonance may have been enhanced in the scenic beauty surveys by showing respondents, prior to requesting the direct judgment, photos of areas that were more attractive than the campgrounds they had already chosen. That is, because our respondents had already chosen their site, the act of choosing and/or the presence of the interviewer may have elevated their expressed opinions of the

chosen area, without affecting the photo-based judgments unless respondents recognized their campground among the photos (an unlikely occurrence excepat at Ashurst Lake, as stated above).

Our objectives, of course, did not anticipate cognitive dissonance--we obtained judgments only after the choice of a campground. Thus, while efforts at dissonance reduction on the part of the respondents is one possible explanation for the extremely high direct evaluations of the chosen camping areas, we cannot test this hypothesis with our data.

Another potential explanation of the results is that participation, at least in pleasant surroundings, may enhance preference for those surroundings. Participants may simply have been indicating by their direct judgments that they were enjoying themselves, and feeling good that they were there. This possibility is supported by several studies of the relative contribution of various factors that affect camper satisfaction. These studies found that scenic beauty and forest characteristics are usually less important to user satisfaction in developed camping than such factors as feelings of comraderie (Dorfman, 1979), feelings of relaxation (Connelly, 1987), and campsite design and facilities (Lime, 1971). If factors such as these were making significant contributions to camper satisfaction at the interview sites, the resulting general level of satisfaction may have influenced the direct judgments, perhaps by leading respondents to give disproportionate weight to the more attractive views.

Similarly, the direct judgments could result from an emotional attachment the campers may have formed to their campsites, which would not exist for the anonymous scenes depicted in the photos. In other words, the fact that the campers were on vacation in a relatively nice setting, perhaps in the company of friends or friendly acquaintances, and in a place that was their temporary "home," might have elevated their direct response, relative to their photo-based responses, regardless of the characteristics of the surrounding forest.

Our data do not support much speculation about the relative importance of these explanations of our results. One finding, however, does provide some information. Ashurst Lake respondents, as noted above, found the photos of the somewhat unique Ashurst Lake area to be more attractive than did the other 10 respondent samples. One possible reason for this lack of agreement is that Ashurst Lake campers may have an unusual preference for forest characteristics like those found at Ashurst Lake. Another possible reason is that, because the uniqueness of Ashurst Lake vegetation made photos taken there more easily recognized by respondents, some Ashurst Lake respondents may have raised their ratings of Ashurst Lake photos to help justify their choice. The former of these two reasons supports the self-selection explanation of our main result, while the latter supports the cognitive dissonance explanation.

Conclusion

The findings of this study are similar to those of previous studies in two ways: group-to-group reliability among the photo-based responses was high, and there was some agreement about relative scenic beauty between the direct and photo-based responses. However, direct judgments of the campground areas were consistently higher than judgments based on the photos of those same areas. Campers direct scenic beauty ratings and rankings of their chosen area were consistently higher than evaluations of the same area represented by photos. Further, direct estimates of willingness to pay to camp at the campground were greater than estimates given for the area when it was depicted in photos.

Choice and participation may have influenced the responses. The three basic possibilities are that self-selection ("I'm here because I like it here"), cognitive dissonance ("I like it here because I chose to be here"), and involvement ("I feel good here") elevated direct responses, but not photo-based responses. Self-selection based on forest characteristics is probably the least important of these because all respondent samples were quite consistent in their photo-based responses. If cognitive dissonance is a factor in the difference between photo-based and direct judgments, the implications of this for valuation depend in part on whether respondents were trying to alleviate an internal sense of dissonance or whether they were just trying to appear intelligent and consistent to the

interviewer. If the latter is the case, we can probably dismiss the direct judgments as a poor basis for evaluating the public's preferences for forest characteristics at campgrounds. However, if the former is a reason for the results, or if involvement alone tends to elevate direct onsite responses, that raises an interesting question about the use of photos to represent actual environmental characteristics. Should managers rely on the comparative photo-based judgments of dispassionate public judges, or the judgments of people who are in the act of using the areas?

Our results suggest that the campers, who had demonstrated in photo-based evaluations that they were discriminating judges of forest conditions, still generally liked where they were more than any photographically represented alternative. Which evaluation, then, is to be believed? Should society disregard the preferences of public panels that provided their reasoned discrimination among a set of options if, in the act of participation, campers report a strong preference for things as they are?

As with many studies, this one raises more issues than it settles. In addition to the larger issue just raised, the relative contribution of the different possible reasons for the difference between the direct and photo-based responses is unsettled. For example, we do not know what effect the absence of man-made objects or humans in the photos had, or the extent to which cognitive dissonance elevated onsite responses. Some studies that would help clarify the

uncertainty are (1) to redo the current study with photos that include all common elements of the scene (e.g., people, equipment, picnic tables and other facilities) and (2) redo the study with respondents randomly assigned to the campgrounds. In any case, however, it is hoped that this study will stimulate discussion and research about the validity of photo-based judgments.

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Footnotes

[1] It is not the purpose of this paper to compare scenic beauty ratings or ranks with the contingent valuation results. That topic is covered by Daniel, Brown, King, Richards, and Stewart (in press).

[2] A twelfth campground was sampled, but was not included in the analysis reported here because of a unique riparian environment within the campground that was avoided in the photos, causing the photo representation of the campground views to be unrepresentative of the onsite views.

[3] The 35 areas included the original 12 (see footnote 2) campgrounds and 20 other pine stands. One of the campgrounds was represented by 2 sets of 6 prints (i.e., 2 pages or "areas"), and another by 3 sets of 6 prints, in order to test for differences in preference among different randomly selected sets of prints from the same campground. No significant differences were found in scenic beauty or willingness to pay among the different sets of prints from the same campground. Mean photo-based responses for these two campgrounds, for comparison with onsite responses, were averaged across the 2 or 3 sets of prints.

[4] In other reliability checks, reported by Daniel et al. (in press), the campers' photo-based judgments were found to correlate highly with non-campers' photo-based evaluations of the scenic beauty of the 20 timber stands and of the 12 campgrounds.

[5] The correlation measure is heavily influenced by the Ashurst Lake data point, which is at the low end of the scale. With Ashurst Lake removed from the analysis, the correlation of Ro to Rp' falls to 0.36, (n=10, one-tailed test, not significant at p=0.05), and the correlation of Zo to Zp' falls to 0.66, ($n = 10$, one-tailed test, $p < 0.05$).

[6] The correlation between onsite and photo-based judgments was also computed in terms of "by-slide" Scenic Beauty Estimates (SBEs, Daniel & Boster, 1976). The SBE transformation of ratings has been used in many studies of forest scenic beauty (e.g., Schroeder & Daniel, 1981; Buhyoff, Wellman, & Daniel, 1982; Brown & Daniel, 1986). Its application here produced a correlation between onsite and photo-based judgments of 0.66, substantially lower than the 0.86 for the Z-score comparison. The lower correlation with the SBEs is attributed principally to the skewed distribution of ratings of the onsite scene (recall that the onsite ratings were unusually high). The SBE "by-slide" procedure assumes a normal distribution of ratings for each scene; its use is not appropriate when the distribution of ratings is highly skewed.

[7] The contingent valuation survey methods and results are not presented in great detail here. They are the subject of the paper by Daniel et al. (in press) and of another paper currently in preparation.

Table 1

Completed Interviews by Campground

Campground	Scenic Beauty Rating	Scenic Beauty Ranking	Contingent Valuation
Spillway	91	32	91
Knoll Lake	15		15
Canyon Point	110	33	112
Ashurst Lake	60	30	62
Pine Grove	63	33	63
Rock Crossing	51		49
Dairy Springs	60		62
Whitehorse A	53	31	55
Whitehorse B	104		102
Kaibab Lake	81	30	80
Dog town	39		36
Total	727	189	727

Table 2

Mean Ratings and Z-scores of Campground Scenic Beauty

Campground[a]	Direct		Photo-based		
			Interviews at Campground	All Interviews	
	(Rating, Ro)	(Z-score, Zo)	(Rating, Rp)	(Rating, Rp')	(Z-score Zp')
Canyon Point	8.44	1.32	7.37	7.40	0.69
Dairy Springs	8.37	1.20	7.72	7.24	0.62
Pine Grove	8.48	1.21	7.66	7.08	0.52
Whitehorse B	8.43	1.36	6.57	7.01	0.49
Knoll Lake	8.07	1.07	6.47	6.59	0.29
Rock Crossing	7.86	1.05	6.88	6.59	0.31
Kaibab Lake	8.29	1.06	6.43	6.41	0.19
Dog Town	8.39	1.13	6.32	6.23	0.10
Whitehorse A	8.45	1.18	6.10	6.20	0.10
Spillway	8.14	1.08	5.55	5.70	-0.16
Ashurst Lake	7.18	0.70	5.96	4.86	-0.59

[a] Arranged in order of decreasing mean photo-based rating from all interviews.

Table 3

Mean Rankings of Scenic Beauty[a]

	Obtained at						
	CP	PG	KB	WA	SP	AL	All
Direct	1.8	1.4	2.3	2.1	2.1	4.1	2.3
Photo-based[b]							
Canyon Point (CP)	2.3	3.0	2.3	2.7	2.8	2.5	2.6
Pine Grove (PG)	3.8	3.5	3.2	4.0	3.3	2.9	3.5
Kaibab Lake (KB)	3.9	3.4	3.9	3.9	3.5	3.5	3.7
Whitehorse A (WA)	4.6	4.9	4.4	4.2	4.9	4.7	4.6
Spillway (SP)	4.9	5.2	5.5	5.0	5.1	4.8	5.1
Ashurst Lake (AL)	6.7	6.6	6.4	6.1	6.4	5.4	6.3

[a] Lower rank indicates higher scenic beauty.

[b] Rows arranged in order of increasing mean rank based on all responses.

Table 4

Mean Total Willingness to Pay (in dollars) per Person per Day

Campground[a]	Direct	Photo-based
Whitehorse B	21.91	17.41
Knoll Lake	23.74	16.94
Canyon Point	19.18	14.74
Ashurst	19.22	13.80
Kaibab Lake	18.60	13.39
Pine Grove	13.62	12.74
Rock Crossing	14.17	12.55
Spillway	20.57	12.42
Dog Town	16.95	12.38
Whitehorse A	18.00	12.33
Dairy Springs	10.95	10.69

[a] Arranged in order of decreasing photo-based willingness to pay.

Figure Captions

Figure 1. Mean scenic beauty ratings of 11 campgrounds.

Figure 2. Mean ranks of 6 campgrounds.

Figure 3. Mean total willingness to pay per person per day of 11 campgrounds.

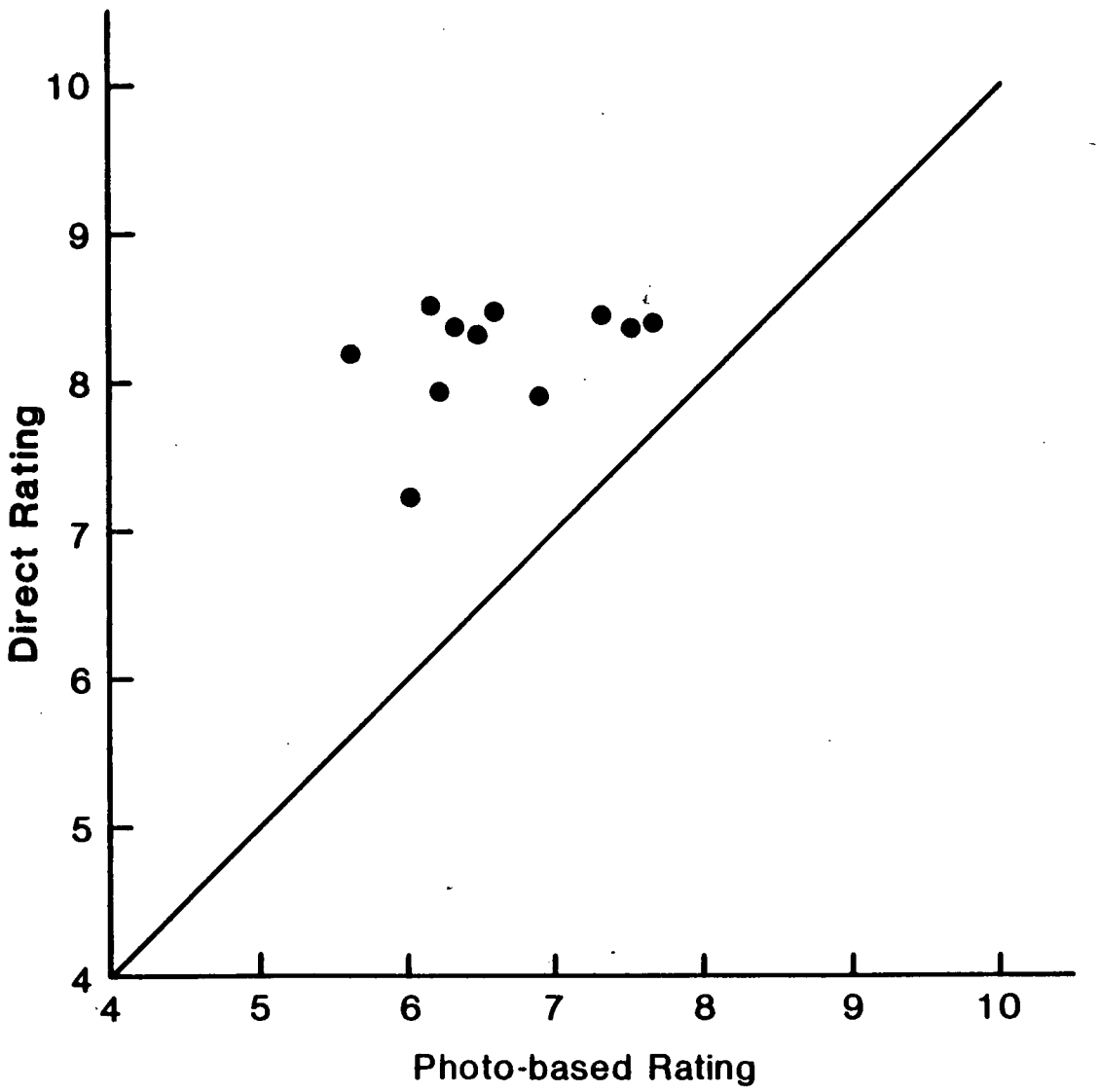

Figure 1. Mean scenic beauty rating of 11 campgrounds.

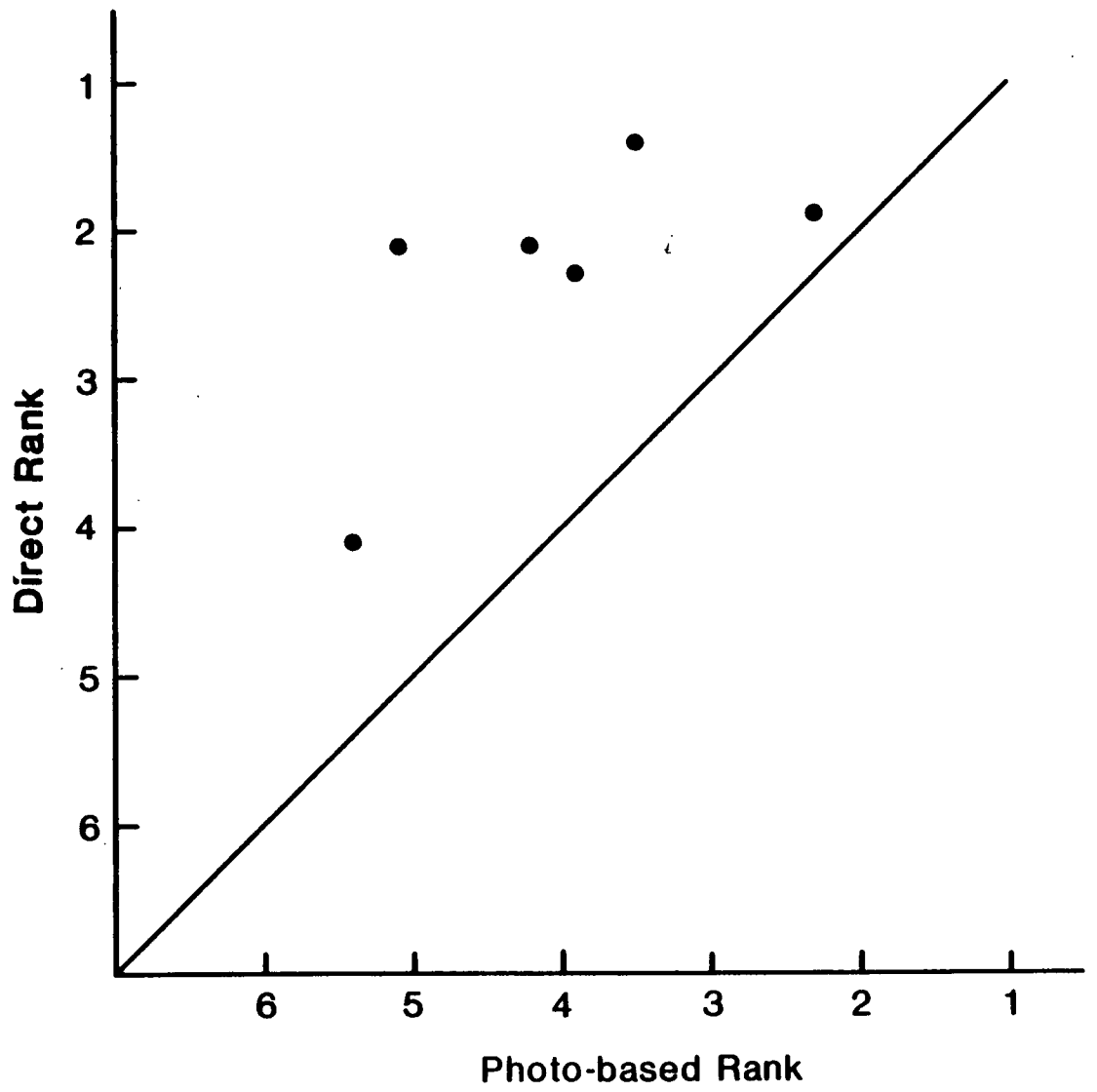

Figure 2. Mean ranks of 6 campgrounds.

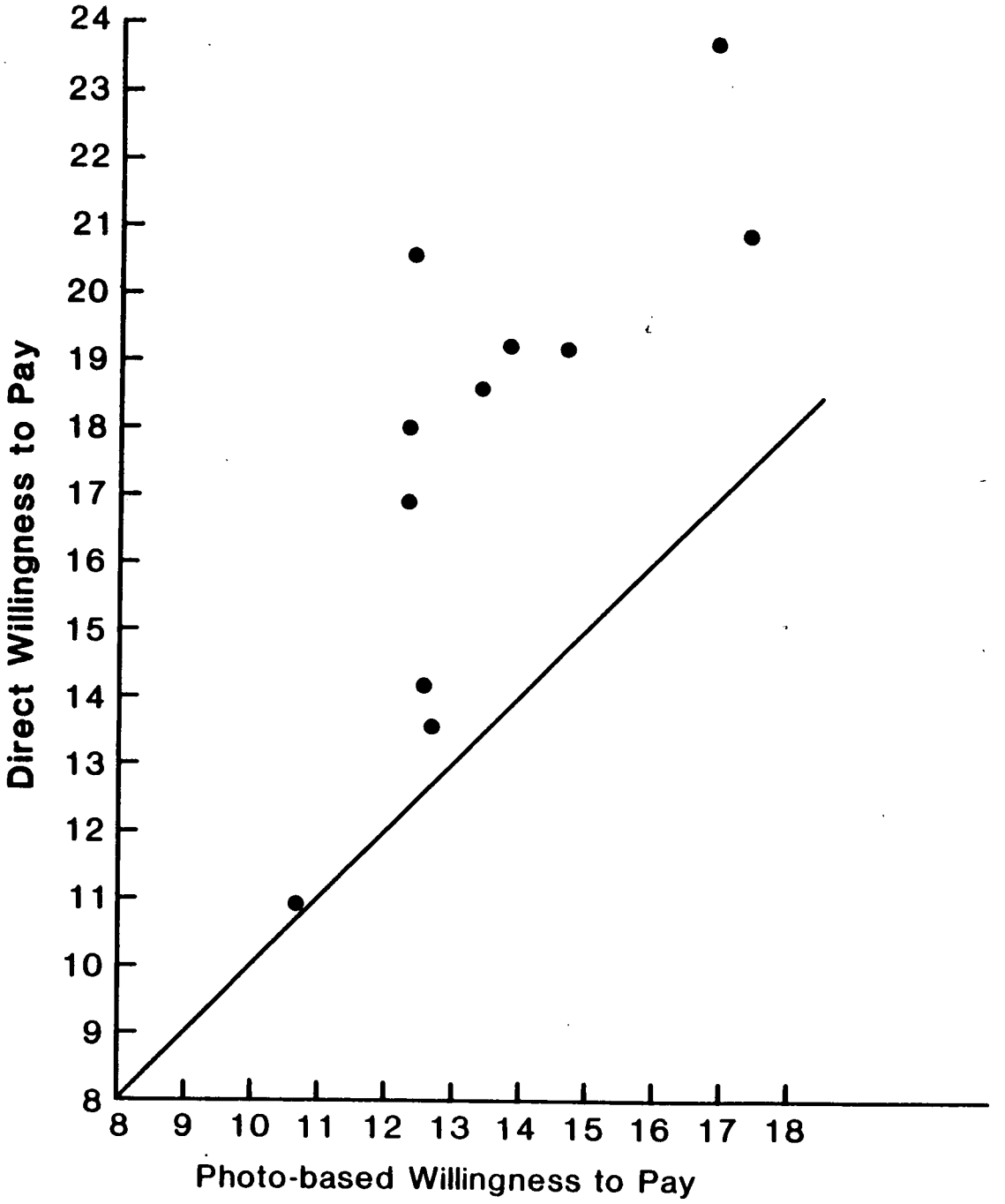

Figure 3. Mean total willingness to pay per person per day of 11 campgrounds.

The Relationship Between Travel Cost and Contingent Value Estimates of Forest Recreation Value

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Running Head: Travel Cost and Contingent Value of Recreation

ABSTRACT

Using data obtained from visitors to forest campgrounds, travel cost models were developed. Bid functions and willingness to pay estimates of recreation value were derived from contingent value questions posed to campers. The willingness to pay responses were based on both photographic representations of forest scenes and on actual forest conditions at each campground. The photo based willingness to pay estimates were significantly correlated with scenic beauty rating estimates made for photo based scenes, but there was little correlation between these values and willingness to pay estimates for actual forest conditions, or estimates from travel cost models. Further, no correlation was found between travel cost estimates and contingent value estimates of the value of forest conditions on-site. The findings raise questions about the validity and comparability of willingness to pay measures that are based on responses to actual forest conditions and for the same conditions evaluated off-site or with photographs.

INTRODUCTION

The planning and management of public forest lands has increasingly emphasized a reliance on quantitative analysis of the relationships between resource uses. Recreational qualities of forests are recognized as vital components in the beneficial use of wildlands. Quantitative methods for recreation assessment are being developed to aid the planning and decision making process of forest management. Two such methods, Travel Cost (TC) and Contingent Value (CV) were employed in a study of forest campgrounds in northern Arizona. The relationships between these methods were explored in the study, with some unexpected results.

The present study is an extension of an earlier study that sought to determine the relationship between perceived scenic beauty, measured by the "Scenic Beauty Estimation" method (Daniel and Boster, 1976) and recreation value as measured by a contingent value approach. Perceived scenic beauty and the importance of forest characteristics to the value of camper's experiences were assessed, and the results of these efforts are reported in Brown, et al. (1988) and Daniel et al. (1989). The purpose of this paper is to report the principal findings of a subsequent study comparing applications of TC and CV methods to measure the value recreationists place on their visits to forest campgrounds. The correspondence between CV and TC methods for measuring the value campers enjoy in their recreation pursuits is discussed and the relationship between these findings and those reported in the previous two papers is explored.

The TC method is well established in the outdoor recreation economics literature (Clawson and Knetsch 1966; Dwyer, Kelly and Bowes 1977). It is an indirect measure of recreationists' value for outdoor activities wherein their expenditure behavior for travel to recreate is used to derive a demand function for the recreation site where the activities take place. An underlying assumption of the method is that people choose to visit a site, ex ante, because of its observable characteristics. The derived demand function provides the basis for a quantitative estimate of the net benefit to the recreationists of using the site. The net benefit estimate is a measure of the recreationists' willingness to pay to use the site, over and above what they actually pay.

The CV method is a direct measure of people's willingness to pay for goods or services that are not typically exchanged in markets (Cummings, Brookshire, and Schulze, 1986). Visitors to forest recreation sites, for example, may be asked their willingness to pay for their recreational experience. In different applications of CV, they may be asked for a single sum, to bid increasing (or decreasing) amounts until the maximum (minimum) willingness to pay is established, or whether they would pay a particular, randomly assigned sum. The method permits assessment of potential (hypothetical) changes in site quality (different contingencies) such as levels of scenic beauty for a given site. Conceptually, the TC and CV methods would give very similar results in terms of benefit estimates, if TC resulted in an income compensated demand function.

Certain differences between TC and CV assessments do result, however, and are discussed in Rowe and Chestnut (1982). For example, the simple TC method leads to an estimation of Marshallian consumer surplus (where the demand function is not adjusted for income). In this study the application of CV led to an estimate of compensating variation expressed as net willingness to pay.

Theory suggests that these two measures of welfare change are expected to differ and that for a welfare loss, consumer surplus will be less than net willingness to pay. This difference is expected because consumer surplus is derived from an ordinary demand curve along which the consumer's utility varies with price and quantity whereas compensating variation is derived from a compensated demand curve along which the consumer's utility is held constant (Mishan 1976).

In the study reported here, net willingness to pay (CV) estimates of value determined in the previous study of forest campgrounds were compared to independently derived value estimates using a TC model. The principal objective of the study was to determine the relationship between these two measures, used as indicators of the relative value of the camping experiences afforded a sample of forest visitors.

METHODS

Data for the CV assessment were taken from a survey of recreationists at 12 national forest campgrounds in northern Arizona during the summer of 1985. The details of the survey and

procedures are reported in Brown et al. and Daniel et al. The campgrounds were selected to represent developed public recreational opportunities in the ponderosa pine forest type in northern Arizona. The level of development, quality of facilities, and variety of recreation opportunities are relatively homogenous across the campgrounds, but the surrounding forest stands varied in age class distributions, densities, and associated plant species. At the extreme, one campground was in a predominantly pinyon-juniper association (within the ponderosa pine type). Campground elevations ranged from 5,600 feet to 7,600 feet and the primary season of use is from the Memorial Day holiday weekend through the Labor Day weekend. Week days and weekend days were sampled equally, and on any sample day visitors at each occupied campsite of a sampled campground were asked to participate in the survey. A total of 1,666 visitors were interviewed. At each of the campgrounds, a bio-physical inventory of forest characteristics was made and the areas were also systematically photographed in a manner to assure representation of forest conditions, but to exclude all people and man-made features.

Visitors were interviewed using one of two survey instruments: a scenic beauty rating instrument and a contingent valuation instrument. Each instrument was administered to approximately equal halves of the samples at each campground. Socio-demographic and travel expenditure data were collected in both forms of the survey instrument. For each respondent, their stated trip expenditures were summed by the interviewer and the total was

confirmed by the respondent. They were then asked how much more they would have been willing to spend on their trip before deciding not to come to the campground. The sum of their actual expenditures plus their stated willingness to pay more was recorded as their maximum willingness to pay value for their visit to the campground. Other portions of the two survey instruments, largely requiring photo-based responses, were distinct, and are described in the above cited papers.

Travel Cost Models

Separate from the on-site visitor survey, fee envelopes collected by the U.S. Forest Service provided season long estimates of total visits to each of the campgrounds as well as additional information on the geographical origins of the campers. These data were used in the TC analysis.

The average number of trips per household per year across all campgrounds was less than 1.5 trips, ranging from 1 to 1.8. This lack of variation in numbers of trips per household precluded estimating a disaggregate or individual observation TC model. Drawing upon recommendations provided in Dwyer, et al. (1977) and Rosenthal, et al. (1986), an aggregate or zonal TC model was estimated for each campground. The model was estimated only for Arizona resident households, which made up 87 percent of the households sampled. Visitors on multiple destination trips were also excluded.

Origin zones were defined on the basis of the cities or towns of visitors' residences. Cities were grouped into origin zones if

they were contiguous or were near each other and shared the same logical travel routes to the campground area. Phoenix is south of the study area and was divided into North and South zones to account for the variation in travel costs across the urban area. A total of 30 origins were defined which comprise all cities of residence for Arizona respondents to the on-site survey.

Stepwise multiple regression analysis was used to estimate a TC model for each of 10 campgrounds.[1] The dependent variable was trips per capita per year from each origin that produced visits to the campground being modeled. The price variable was travel cost per person per trip. Other independent variables represented substitute campgrounds and socio-demographic characteristics of each origin. Demand functions for each campground were derived from the models and corresponding estimates of net benefit, or willingness to pay for the on-site experience, were obtained.

Contingent Value Bid Functions

For comparison with TC values, CV responses were expressed as net willingness to pay per person per trip, and as aggregate (across all visitors per year) net willingness to pay for each campground. To reduce the possible bias introduced by respondents who may have expressed high values to ensure the continued existence of the campground, 28 households whose maximum willingness to pay was more than three standard deviations greater

[1]One of the original 12 campgrounds was dropped from the analysis since its water system failed and too few interviews were obtained for reasonable analysis. Two of the campgrounds are adjacent and logically must be treated as one in zonal TC analysis.

than its grand mean were eliminated from the analysis. Twenty-six households who said they would not come back to the campground apparently had not received sufficient utility from the experience to justify their trip expenditures. Because consumer behavior theory is based on the assumption of constrained utility maximization, these 26 observations were dropped from the analysis (Deaton and Muellbauer 1980). Of the 1,666 interviews, 1,470 were usable in the study.

Valid CV value estimates would be expected to be sensitive to those variables suggested by consumer behavior theory and common sense. Hence, correlation and multiple regression analysis were used to evaluate the validity of the CV estimates derived from the earlier visitor survey. Net willingness to pay for a trip was conceived to be a function of income, the cost of getting to the campground, the nature of the camping experience, stage of family life cycle, and campground preference.

Specifically, the dependent variable was the additional amount per person respondents said they would have been willing to spend rather than not take the trip (MORE). Reported household income (INCOME) before taxes was used as the income variable. Reported expenditures per person for gasoline used on the trip were used as the measure of transportation costs (GAS). The nature of the camping experience was represented by 1) reported non-transportation expenditures which, in this case, are primarily related to the on-site portion of the trip (ONEXP); 2) length of stay (STAY); 3) whether or not a tent was used as the primary camp

shelter (TENT); and 4) whether or not this trip was the first to this campground (FIRST). Age of the respondent was used as a measure of stage of family life cycle (AGE). Preference for the campground was represented by whether or not the campground was the respondent's first choice for this trip (CHOICE1). Additionally, natural logarithmic transformations of MORE, INCOME, GAS, and ONEXP were examined.

Using these operational variables, we attempted to estimate bid functions for each of the 10 campgrounds. The simple correlations among the variables for each campground were used to choose the form of the dependent variable and the set and form of the independent variables to be entered in a stepwise regression procedure.

RESULTS

As Table 1 reveals, the estimation of zonal travel cost models for each campground resulted in very robust models. The adjusted R^2 values ranged from 0.40 to 0.92 and the price coefficients were significant at a probability level of 0.05 or less. Price elasticities were calculated for each model and are also shown in Table 1. With the exception of Christopher Creek campground, the elasticity estimates indicate visitors to these campgrounds are price sensitive and demands are elastic. The demand functions showed a mean (across origins for a campground) net benefit estimate, or willingness to pay per person per trip (CST) value, that ranged from $7.18 to $31.67 (Table 2).

The contingent value measure appropriate for comparison with CST is mean net willingness to pay per person per trip (WTPT) derived from the on-site response of campground visitors. WTPT values ranged from $6.88 to $28.93 (Table 3). While both CST and WTPT values are of the same magnitude and approximate range, there is essentially no correlation between them ($r=0.09$, $p<.05$). Theoretical discussions on the expected relationship suggest that WTPT should be somewhat higher in value than CST (Cummings, Brookshire and Schulze, 1986) and contingent value measures in other empirical studies have shown such a relationship (Rowe and Chestnut, 1982). While average WTPT was higher than CST across the 10 campgrounds ($18.11 and $16.06, respectively) the relationship was inconsistent; for several of the campgrounds WTPT was less than CST.

Validity of CV Estimates

Values of the adjusted R^2's for the estimated CV bid functions ranged from 0.0 to 0.52 (Table 4). Seven of the 10 functions had R^2's significant at $p<.01$. The number of independent variables entered through the stepwise procedure ranged from 0 to 3, of the 8 in the set tested in each case. Income entered 3 of the 10 functions, gas expenditures 2, on-site expenditures 5, length of stay 5, first trip to the campground 2, age 1, and whether or not the campground was first choice 1. These results suggest that the relationship of these variables to net willingness to pay is statistically significant, but that in all but one case, less than half the variance in net willingness to pay is explained. The

variation across campgrounds in the independent variables that entered indicates the lack of a general, stable relationship. If such a general relationship existed, one would expect the same variables to enter each of the functions even though they may have differed in functional form and in specific regression coefficients. The lack of a consistent relationship between TC and CV assessments is, at least in part, due to the lack of internal consistency (reliability) of the CV estimates.

DISCUSSION

The values for the campgrounds expressed in dollar terms, either through CV or TC, are substantial. People's behavior and their survey responses indicate that most are willing to pay more than they actually do to visit these sites and that part of their willingness to pay is for the forest scenery surrounding the campgrounds. The lack of correlation between the CV and TC measures is difficult to explain and more troublesome than the fact that for some campgrounds CV was less than TC. However, the direct willingness to pay values expressed on-site (CV), are inconsistent with expectations in other relationships as well.

CV and SBE responses derived from photographs of the campgrounds in the on-site visitor survey provided one approach to investigating the unexpected lack of correlation between CST and WTPT. If the photo-based measures correlated with one of these measures but not the other, we would have at least some basis for favoring one measure over the other. However, neither CST nor WTPT

(from Tables 2 and 3, respectively) was significantly correlated with the photo-based measures reported in the previous papers (Table 5). Thus, the photo-based measures do not lend support to either CST or WTPT as the more accurate measure. The lack of correlation is not surprising, given that the photo-based measures assessed recreators' perceptions only of the forest conditions at the campsites, all other things being equal. Both CST and WTPT measures apply to the camping experience as a whole. One indication of the lack of correspondence to the photo-based measures may be that forest scenic beauty was not a major determinant of the value of the experience at a campground.

A more basic comparison, between visitors' mean (across campgrounds) stated gas expenditures and their mean travel costs (estimated as round trip mileage times cost per mile) used in the TC analysis, resulted in a significant correlation of 0.85. This finding lends validity to both the imputed price used in the TC analysis and the visitors' estimates of their travel costs, and suggests that the divergence between the TC and CV measures comes in the estimation of the additional willingness to pay, or net benefit values for the sites.

Hoehn and Randall (1987) provide a useful basis for discussing these results. They point out that the CV method proceeds on the assumption that respondents believe that the information they and others provide will impact policy. Given this assumption, the respondent has an incentive to both form a valuation and to report that valuation to influence the CV estimate and the policy. The

so-called hypothetical bias in CV estimates, if it exists, is associated with the value formulation problem. The strategic behavior bias is associated with the value statement problem. Viewing our CV design and results in light of these two decision problems is useful to understanding possible sources of the inconsistency in the estimates.

In formulating a value response, the respondent uses experience and market information. Our CV estimates are based on responses from respondents who had already formed a value (by reporting trip expenditures) and, further, who had reported previous camping experience and a desire to camp at the campground in the future.

The market information provided in the questionnaire, however, may have been inadequate. After reporting their trip expenditures in three categories and being presented with the resultant sum of expenditures, the respondents were asked to respond to the following situation:

> "We are interested in knowing how much <u>more</u> you (your household) would have been willing to spend on this trip before deciding not to come to this campground--that is, before deciding to do something else or to stay at home. How much <u>more</u> do you think you would have been willing to spend?"

In a previous statement the respondents had been told that the interviewer was interested in "the value of this campground to the people who visit it." The scenario implies a policy decision regarding the campground, but the nature of that decision is unclear--whether it is a decision to continue or not to continue

to provide the campground under present conditions or a decision regarding campground fees or both. Further, in an effort to avoid payment vehicle bias no specific payment vehicle was specified, which may have added to the respondents' uncertainty about the policy and its mode of implementation, what Hoehn and Randall refer to as communication error (p.230). They show that in the presence of "random noise," the valuation formulated by respondents will be less than the valuation formulated under conditions of ideal communication.

For the second problem, the statement of value, Hoehn and Randall define five models of the CV decision context, which influence strategic behavior. The models are defined on the basis of three dimensions, the nature of the policy change, the policy decision rule, and the rule for determining individual's payments.

On the basis of elimination, the decision context in this study corresponds most closely to their Model 4, in which the respondent believes the proposed policy will be implemented if benefits exceed costs and that each user will pay in proportion to their stated valuation. However, because the three context dimensions were not clearly defined for the respondents in this study, we cannot be sure they viewed the decision context in this way. Hoehn and Randall conclude that in the absence of clarity about the decision context, there would be no incentive for the respondent to overstate his/her formulated value. This could result in less than expected WTPT values.

It would appear that the observed inconsistency in the on-site CV estimates may have been due to a communication error and the vagueness of the decision context. This lack of reliability in the CV estimates is a likely cause of the lack of correlation between the TC and the CV estimates. However, in spite of their generally good statistical performance we cannot be certain about the reliability of our TC estimates.

Smith, Desvousges, and Fisher (1986) compared CV and TC estimates of the value of a change in water quality at a number of U.S. Army Corps of Engineers recreation sites, as well as several sites along the Monongahela River in Pennsylvania. Attempts to compare mean benefit estimates for the numerous and varied Corps sites between CV measures and three methods of TC analysis, two of which involved sophisticated approaches and included an income compensated demand model, showed no reasonable correspondence. Both their CV and TC measures were well constructed and theoretically sound, avoiding or controlling for potential biases. They were able to obtain a "close" correspondence between measures (statistical value unreported) only with a simple (Marshallian) TC model and with a carefully drawn data set (relatively homogeneous Monongahela sites) that permitted paired responses between TC and CV for each of 69 individuals. They conclude that the influence of judgment, commonly recognized as a problem in the design of CV survey instruments, can influence TC estimates as well, in model specification and estimation.

In the TC analysis, efforts to include important socio-demographic variables as well as measures for substitute sites yielded mixed results, but the models were no doubt improved by controlling for these potential differences in visitors and their desires (Hof and King, 1982). One of the most troublesome aspects of TC models is the failure to adequately account for the effect of travel time on the predicted visitation rate. The problem is due to multicollinearity between money cost (based on distance traveled) and travel time (also based on distance traveled) in regression models and is especially prevalent with aggregate, or zonal, models. We asked respondents to estimate their travel time from home to the campground where they were interviewed in order to obtain a more realistic measure of travel time than that derived from distance traveled. These data were included in regression runs as independent variables, but they still appeared to be collinear with the travel cost terms and the time variable was dropped from the models. Failure to account for time will result in underestimates of aggregate willingness to pay value, all else equal. The underestimates are not simply a function of a parallel demand shift, but may result from a slope change as well, thus altering the relative relationship of the CST values.

Mendelsohn and Markstrom (1988) argue that while multiple destination visitors should be excluded from analysis during model building, they should be included in the calculation of consumer surplus. We did not include multiple destination visitors in our determination of aggregate willingness to pay values, thereby

obtaining more conservative dollar estimates. Since the number of multiple destination visitors varied by campground, ranging from 10 percent to 46 percent of total visitation, the lack of direct correspondence between the CV respondents and those visitors used to derive TC values could be a problem. (Four campgrounds had greater than 25 percent of visitors traveling to multiple destinations).

Rosenthal, et al. (1986) recommend using all origins for the market area (Arizona) for all campgrounds in the analysis, even when some campgrounds have zero visits from one or more origins. This presents mathematical difficulties when the functional form of the estimated demand function is logarithmically transformed in the dependent variable; zero visits will not work. The recommended solution for this problem is to assume one visit from zero visit origins. However, the structure of the origin zones defined for this study presented an additional complication. Some of the origins with a very small number of actual visits were also far away from a given campground and had very small populations. After expanding the actual visits by the appropriate sampling rate (done for all visit data for each campground) and dividing this value by the relatively small origin population, an unrealistically high number of visits per capita, relative to the distance to the campground, was predicted for these origins. They were considered to be outliers and dropped from the analysis of the given campground. The effect of this procedure on aggregate estimates of value is not known.

The use of zonal TC models in this study was necessitated by the relatively few number visits per year to each campground made by households from each origin, plus the fact that visitor data were collected on-site rather than at visitors' origins. A household survey, at a cost beyond the budget and intent of this study, would have permitted the estimation of a hedonic travel cost model (Mendelsohn and Markstrom, 1988). This approach permits a more explicit treatment of specific site characteristics as they influence visitors' choices about the forest campgrounds they want to go to. Conceptually, at least, a hedonic TC model could elicit visitor value judgments based on the same market situations hypothesized for respondents to the CV analysis.

Nonetheless, the fact that TC analysis is based on behavior rather than responses to a hypothetical market, as well as the robustness of the TC models reported in this study, lends an aura of greater validity to the TC estimates than to the CV estimates. It is not clear, however, whether the unreliability of the CV values is primarily a methodological problem or whether the nature of responses from recreators, on-site, is a contributing factor.

Brown, et al. (1988) found that photo-based SBE and CV were lower than direct survey responses for actual conditions. They suggest that respondents may have elevated their value of the campground they were in because they had chosen to be there and gave on-site responses that would not make them appear inconsistent or foolish to the interviewer.

Also, respondents may simply have been enjoying themselves, were pleased with their surroundings, including the social and man-made elements of the campground, and found the forest scenery to be a relatively small part of their overall experience. Related to this is the possibility of campers having an emotional attachment to the campground as a temporary "home." This could induce feelings of "ownership" for the campground with correspondingly elevated values as compared to values provided by an objective observer.

If this tendency of respondents to elevate survey responses about their chosen campground existed, it could help explain the generally higher CV than TC measures of value across the 10 campgrounds. However, it does not help to explain the lack of correlation between the CV and TC measures.

CONCLUSIONS

The findings of this study raise questions about the validity and comparability of various willingness to pay measures that are based on responses to both actual forest conditions and for the same forest conditions evaluated off-site or with photographs. The generalized application of TC or CV methods to assess the value of visitors' experiences in national forest campgrounds should be done with caution. In addition to concerns for the influence of social and physical characteristics of recreation sites, other than the forest conditions, there are clearly a number of methodological issues related to CV and TC analysis that remain to be resolved.

In particular, the sociological and psychological factors that contribute to visitors' selection and valuation of recreation sites are only implicitly treated in TC and CV analyses. A more thorough understanding on how such factors effect value formulation is called for. Also, the way that the social and physical attributes of a recreation site contribute to the value of the forest camping experience must be understood.

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Table 1. Regression Statistics by Campground Model

Model	Form[a]	Independent Variable Coefficients[b] Constant	Price	Income	Education	Age	Substitutes[c]	Adj. R^2	Elasticity
Spillway	SLI	.03516 (6.736)*	-.00757 (5.627)*	-.00000 (1.957)‡				.77	-1.8925
Christopher Creek	SLD	-3.09842 (2.495)+	-.03191 (2.480)+			-.06187 (1.487)‡		.40	-0.7087
Canyon Point	SLI	.04875 (6.908)*	-.00939 (4.849)+	-.00000 (2.672)+				.78	-1.5650
Pine Grove	SLI	.13626 (4.879)+	-.00471 (4.416)+		-.00922 (3.956)+			.78	-1.5700
Ashurst Lake	SLD	-7.66131 (5.117)*	-.09245 (4.654)*			.13258 (2.862)+		.66	-2.4844
Rock Crossing	DL	90.92967 (2.469)+	-2.44361 (3.483)+	.00030 (2.220)‡	-7.39274 (2.749)+			.49	-2.4436
Dairy Springs	SLI	.00927 (5.218)*	-.00215 (7.176)*	-.00000 (3.266)+		.00014 (3.264)+		.89	-1.0750
Whitehorse Lake	SLD	-4.28029 (6.893)*	-.07719 (6.679)*				.04786(SP) (2.756)+	.72	-2.3789
Kaibab Lake	SLD	-2.85000 (2.298)+	-.06834 (4.896)*	-.00018 (1.904)‡			.04391(CC) (2.868)+	.68	-1.9183
Dogtown Res.	DL	179.77548 (6.372)*	-2.22512 (7.556)*		-14.08034 (6.358)*			.92	-2.2251

[a] Functional form: SLI (Semi-Log Independent); SLD (Semi-Log Dependent); DL (Double Log)
[b] 't'-statistics in parentheses, significance level: *=.010; +=.050; ‡=.100
[c] Substitute campground noted in parentheses: SP=Spillway; CC=Christopher Creek

Table 2. Consumer Surplus Values for TC Analysis by Campground

Campground	Aggregate Consumer Surplus	Consumer Surplus Per Person Per Trip[a]
Spillway	$ 45,260	$ 7.18
Christopher Creek	$ 208,928	$ 31.67
Canyon Point	$ 57,637	$ 7.46
Pine Grove	$ 58,874	$ 13.35
Ashurst Lake	$ 37,989	$ 10.88
Rock Crossing	$ 43,737	$ 20.50
Dairy Springs	$ 45,907	$ 15.35
Whitehorse Lake	$ 104,829	$ 13.09
Kaibab Lake	$ 77,012	$ 14.73
Dogtown Reservoir	$ 95,236	$ 26.43

[a]Aggregate consumer surplus divided by the predicted number of trips at a zero fee increase, where each visitor to a campground counts as one trip.

Table 3. Consumer Surplus Values for CV Analysis by Campground

Campground	Aggregate Consumer Surplus	Consumer Surplus Per Person Per Trip
Spillway	$100,628	$20.37
Christopher Creek	$160,996	$28.93
Canyon Point	$173,903	$27.82
Pine Grove	$ 70,711	$18.53
Ashurst Lake	$ 25,764	$ 8.71
Rock Crossing	$ 14,950	$ 6.88
Dairy Springs	$ 22,644	$ 8.88
Whitehorse Lake	$142,166	$19.90
Kaibab Lake	$ 89,971	$23.04
Dogtown Reservoir	$ 60,532	$18.08

Table 4. Bid Function Regression Statistics

Campground	Dependent Variable	Coefficients of Independent Variables[a]												Adj. R^2	F	d.f.
		CONSTANT	INCOME	ln (INCOME)	GAS	ln (GAS)	ONEXP	ln (ONEXP)	STAY	TENT	FIRST	AGE	CHOILE			
Spillway	MORE	-16.833 (-1.510)						11.459 (3.398)*						0.11	11.56*	1,81
Christopher Creek	MORE	0.93 (1.632)				0.878 (4.777)*		0.331 (1.759)†				-0.025 (-3.056)*		0.36	17.27*	3,90
Canyon Point	ln(MORE)	-14.922 (-1.955)†	0.0004 (3.431)*		0.789 (2.976)*				3.463 (3.670)*					0.31	13.57*	3,80
Pine Grove	MORE	6.576 (0.729)							2.427 (2.665)*					0.18	7.09*	1,27
Ashnest Lake	MORE	11.586 (4.179)*			0.575 (4.979)*				-2.984 (-3.965)*		-5.832 (-1.985)†			0.36	10.08*	3,46
Rock Crossing	MORE	8.766 (0.546)					0.197 (3.077)*		1.584 (2.265)**		-3.167 (-2.008)†			0.52	16.22*	3,40
Dairy Springs	MORE	24.000 (5.622)*											-18.184 (-2.605)*	0.17	6.78*	1,28
Whitehorse Lake	MORE	-33.819 (-2.548)*	0.0003 (2.582)*					11.706 (2.665)*	1.923 (1.913)†					0.15	8.91*	3,127
Fatbab Lake	MORE	7.265 (1.284)	-0.0002 (-1.921)†				0.719 (4.759)*							0.32	12.09*	2,46
Dogtown Res.														0.00		0,92

[a] "t" statistics in parentheses, significance levels: * = .01; ** = .05; † = .10.

Table 5. Mean Willingness to Pay Values and Mean Scenic Beauty Ratings in Two Comparative Evaluation Contexts by Campground

	DIRECT-INDIRECT		PHOTO-BASED[a]-PHOTO-BASED[a]	
CAMPGROUND[b]	WTPT($)	CST($)	CV($)	SBE
Christopher Creek	28.93	31.67	-10.46	-25
Canyon Point	27.82	7.46	17.52	78
Kaibab Lake	23.04	14.73	2.21	25
Spillway	20.37	7.18	-3.99	-13
Whitehorse A	19.90	13.09	2.73	17
Whitehorse B[c]	19.90	13.09	11.66	54
Pine Grove	18.53	13.35	6.11	57
Dogtown	18.08	26.43	0.86	15
Dairy Springs	8.88	15.35	12.22	70
Ashurst Lake	8.71	10.88	2.67	-58
Rock Crossing	6.88	20.50	2.07	35

[a] Data are adapted from Daniel et al. (1989); $r=0.77$, $p<0.01$.
[b] Listed in descending order of WTPT values.
[c] The Whitehorse A and B complex was treated as a single campground when estimating WTPT and CST.

SCENIC BEAUTY MODELS

FOR

FOREST CAMPGROUNDS

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Running head: Scenic beauty models

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ABSTRACT

Management of recreational sites would be improved if biophysical predictors of forest scenic beauty for recreation areas were identified based on the perceptions of recreational users. The Scenic Beauty Estimation (SBE) method has been shown to be useful in the development and application of various scenic beauty models for general forest scenes. These models have been based on the scenic beauty judgments of the general public and biophysical variables that are measurable by standard forest and range techniques. Campground scenic beauty models were developed that were based on campground biophysical inventory features and SBEs of general public groups. Results show that managers should place concern on forest overstory characteristics, in order to improve campground scenic beauty. Increases in scenic beauty were related to increases in the average diameter of ponderosa pine trees at a campground site. Decreases in scenic beauty were related to increases in the number of intermediate-sized ponderosa pine trees per site.

INTRODUCTION

Growing public concern for the scenic quality of forest environments has pressured resource managers to place greater emphasis on public judgments of landscape quality in relation to management decisions. Both the Forest and Rangeland Renewable Resources Planning Act of 1974 and the National Forest Management Act of 1976 require public resource managers to consider public environmental amenity values in forest planning. The Scenic Beauty Estimation (SBE) method, developed by Daniel and Boster (1976), measures scenic quality through public perceptual judgments of scenic beauty and has been used in the development of various scenic beauty models which are useful in forest management applications (Arthur 1977, Schroeder and Daniel 1981, Brown and Daniel 1984).

Near-view SBE models quantify scenic beauty by relating how the public perceives and rates the scenic quality for a variety of non-vista scenes, to biophysical features in a particular landscape. These biophysical features include characteristics such as the size and number of trees, crown canopy, number of tree stories, percentage of herbage and ground cover, and percentage of downed wood or slash noticeable on a site.

Although near-view SBE models for general forest scenes are useful in forest management applications, they may not be applicable to campground areas. Certain aspects related to campground areas may cause them to be different from general forest landscapes. This may cause campground environments to be

perceived differently from a typical forest scene. Some differences may be related to potential environmental impacts that occur on site that alter biophysical characteristics. For example, campground areas may be characterized by trampled understory vegetation or a lack of downed wood and dead limbs on trees, collected by campground visitors for use as firewood. The establishment of developed campgrounds on forested areas may also be specifically limited to areas suitable for recreational use, as outlined by recommended agency site selection guidelines. However, identifying specific site selection guidelines for particular regions or districts is often difficult due to highly specific study site conditions and research findings of various site selection studies (James 1974).

Some basic guidelines relating spatial factors, such as topography, vegetation, soils, microclimate, and water, to campground site selection as well as results from recreational impact studies, allow resource managers to identify which potential sites have the best capabilities to withstand recreational use (LaPage 1962, Ripley 1962, Magil and Nord 1963, Dotzenko et al. 1967, Cieslinski and Wagar 1970, Herrington and Beardsley 1970, Settergren and Cole 1970, James 1974, Jubenville 1976, McEwen and Tocher 1976, Young and Gilmore 1976, Douglass 1982, Knudson 1984). Areas that appear to be ideal for campground site selection may be further limited by various non-recreation related objectives a manager may have for that site. For example, a manager may select a site for recreation which has

non-commercial or a low degree of commercial tree species instead of an area with a high degree of commercial tree species if both areas are of equal benefit in terms of recreational suitability. In addition, although recreationists differ in their preference for the degree of remoteness from population centers, most campgrounds must be located near some type of road system. Therefore, deliberate placement of campgrounds next to roads, an example of a process referred to as collocation (Jameson et al. 1972), will produce one further limitation on the type of areas where campgrounds may be located.

Known scenic beauty preferences of campground users would be a further aid to recreation resource managers. The satisfaction of recreationists in a forest environment is affected to some degree by the scenic quality of the landscape. However, there are limited research findings which specifically identify scenic beauty preferences of campers as related to the near-view biophysical characteristics surrounding forest campground areas (Brown, et al. 1988, Daniel, et al. 1988). The objectives of this study were to determine the accuracy of current scenic beauty models for campground scenic beauty prediction and to develop more reliable campground scenic beauty models based on biophysical forest characteristics found in and around developed campgrounds.

METHODS

Study Area

Twelve developed campgrounds, located on national forests in northern Arizona were selected for study. The climate of forested areas in northern Arizona has been described as cool and mostly subhumid. Elevation of the sites ranges from 5,600 ft to 7,600 ft. All sites are predominantly a ponderosa pine (Pinus ponderosa Laws.) forest type, with the exception of one juniper (Juniperus monosperma Sarg.) forested site and one mixed-conifer forested site. Most sites are two-storied forest stands. Individual campsite units ranged from 25 to 78 at the 12 study sites. Access to six sites is on a paved road. For other sites, distance from a paved road ranges from one to 21 miles on maintained gravel or dirt roads. All sites have a lake or stream present or nearby. Boating at campgrounds with lakes is restricted to electric motors. All campgrounds also have drinking-water available and some type of restroom facilities. Season of use for the sites is from Memorial Day to Labor Day.

At each campground, photographic and physical data were collected to represent a range of biophysical forest conditions found in and around the campgrounds. A near-view photograph was taken (avoiding man-made features) at approximately 12 selected locations per campground in May and again in August of 1985. Near-view scenes do not include distant features and emphasize biophysical characteristics generally within 100 yards of the observer (Brown and Daniel 1984). After photographs were taken

in August, sites were inventoried using standard forest and range inventory techniques. A 360 degree biophysical feature sample was used centered at the point where photographs were taken. Trees five inches in diameter at breast height (dbh) and greater were inventoried using a 10-basal area factor (BAF) tally. Tree characteristics measured included items such as tree diameters, tree species, and tree heights (1). Seedlings and saplings were tallied by species and grouped into size classes on a 1/100 acre area.

Measurements on ground cover characteristics, such as the percentage of bare ground and herbaceous cover, were ocularly estimated over a 1/10 acre area. In an area of 9.6 square feet, the heights and percentage cover of grasses, forbs, and shrubs were measured. This vegetation was then clipped and collected and later dried to obtain oven-dry sample weights.

Scenic Beauty Judgments

Photograph sets and individual slides of campground sites were shown to campers on-site and to general university student groups.

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(1) Due to the large number of juniper trees at Ashurst Lake campground, a fixed plot (1/10 acre) was established at each inventory point; juniper tree diameters were measured at root collar according to procedures outlined by the Intermountain Forest and Range Experiment Station Forest Survey Field Procedures Manual (USDA 1985).

Respondents rated campground scenes for "scenic beauty" on a 10-point scale according to procedures outlined by the SBE method (Daniel and Boster 1976) and under varying rating instructions. Ratings were later transformed to "scenic beauty estimates" or SBE values according to the SBE method "by-slide" procedure (Daniel and Boster 1976) before any analysis using the scenic beauty ratings was conducted.

Eight hundred and thirty three campers rated 35 photograph sets depicting a variety of biophysical forest conditions and landscapes in northern Arizona. The 35 sets were arranged into one of six different orders and placed in a photograph book; the different orders were made to prevent rating order bias. A set (presented on one page in a photograph book) consisted of six individual photographs with each set representing one forest area or stand. Campground forest scenes taken in May for each campground were represented by at least one photograph set for each campground among the total 35 sets (all other sets represented near-view general forest scenes in northern Arizona). Campers were instructed to rate each set (a stand-level rating) and were told the sets were representative of the forest conditions surrounding campground areas, but were not informed of the actual locations of the areas depicted by the photograph sets.

A total of 100 general university students from the University of Arizona (UA) participated in slide presentations conducted to obtain SBE ratings comparable to those obtained from

campers. Slides were limited to the near-view campground scenes taken in August to maintain a "better-fit" during regression analysis (for building campground models) between SBE ratings and biophysical data for these sites, also collected in August. Ratings reported here were also limited to site-level SBE ratings (individual slide ratings for each campground plot) since stand-level campground models could not be developed. With a total sample size of 12 campgrounds (or stands), allowances for multiple regression degrees of freedom could not met to develop stand-level models given the large number of independent variables considered in model development. The students participated in one of three sample groups. Each group rated 130 slides. The 130 slides were randomly reordered for each presentation to prevent rating bias that might occur if all groups evaluated the same slide order. Before slides were presented to each sample group, standardized instructions were read aloud to ensure that all students would have the same rating instructions. Students were informed that the scenes represented general forest scenes and instructed to rate slides on the same 10-point scale used by campers.

Tests of Current Scenic Beauty Models

Tests were conducted to evaluate selected current scenic beauty models developed by Brown and Daniel (1984) and Schroeder and Daniel (1981) (Figure 1, Figure 2). Tests were not intended to revalidate the current scenic beauty models, but to identify

if key biophysical predictors (and model coefficients) could be applicable to campground settings. Both stand-level and site-level models were selected for tests. Generally a site-level model is based on site-level data (plot-level data), with a site (plot) defined as the area directly around a specific forest inventory point (Brown and Daniel 1984). A stand-level model (or stand-level data) is based on aggregated site-level data. Models tested were limited to those developed with the SBE method. Due to the lack of noticeable downed wood material found at the campground study sites, detailed downed-wood (and post-harvest) scenic beauty models were not used in the tests.

The two major tests used were: (1) a Pearson correlation analysis comparing SBEs given by campers and students for campground scenes to SBEs yielded by scenic beauty models for the same campground scenes, and (2) a comparison of the common variance reported for the current scenic beauty models to the variance yielded by the models when SBE values (actual and predicted) of campers and students were used. Before tests were conducted, the SBE ratings of campers were averaged to yield one stand-level SBE rating per campground (or stand) and a student group weighted mean was calculated to yield one site-level SBE rating per campground plot. Since Brown and Daniel (1986) have shown that site-level models can be used to predict stand-level scenic beauty, both of these types of models were tested against camper scenic beauty ratings. Tests using student SBE ratings were limited to site-level model prediction.

For the first model test, a minimum correlation coefficient of 0.60 was selected *a priori* to determine if there was a sufficient association between actual and predicted SBE values. At this critical point Type I errors can be controlled. Also, when Schroeder and Daniel (1981) used this method of model validation, it was concluded that models were satisfactory given correlation coefficients of 0.679 and greater. For the second model test, the observed residual mean square (ORMS) estimated by each model was compared to the predicted residual mean square (PRMS) (Snee 1977) obtained for each model when using camper and student SBE ratings. The PRMS can be computed as follows:

$$PRMS = \frac{(Yi - \hat{Y}i)^2}{n - m - 1}$$

where $\hat{Y}i$ = predicted SBE rating
Yi = actual SBE rating
n = total number of data points
m = number of independent variables in the regression model.

The ORMS value was computed as the square of the standard error reported for each regression model. A ratio of PRMS to ORMS approximately equal to one or less would indicate that the models have the ability to satisfactorily predict the scenic beauty of the campground areas rated by campers and students.

Campground Model Development

Ninety-six biophysical variables (and 45 comprehensive variables combining two or more intercorrelated variables) were

analyzed in campground scenic beauty model development. The variables were limited to those that can be measured by standard forest and range techniques, making data requirements of the models easy to obtain by managers and the models easy to apply to management decisions. Many of the variables analyzed were found to be significant in past scenic beauty modeling efforts (Brown 1983, Brown and Daniel 1984). The original ninety-six variables included items such as average tree diameter (per species), average tree height (per species), number of trees per acre (per species/per diameter class), and percent herbaceous cover of grasses, forbs, or shrubs (oven-dry weight lbs/acre).

Two site-level campground scenic beauty models were developed using multiple regression techniques. The first model, referred to as the PINE model, was limited to data measures from the 10 campgrounds (107 site-level plots) that are predominantly a ponderosa pine forest type. In an attempt to find a model that would be applicable to all campground sites used in this study, a second campground scenic beauty model, referred to as the GENERAL model, was based on all of the campground site-level data (130 plots) from the 12 campgrounds. However, further analysis, to be discussed later, showed that this type of model could be misleading.

Stepwise multiple regression analysis was conducted, to determine which biophysical variables contribute the most to the prediction of campground scenic beauty. A significance level of 0.05 was selected for a variable to enter an equation and a level

of 0.10 was selected for variable exit. To avoid potential multicolinearity problems, intercorrelated variables were either used exclusive of each other or combined into logical comprehensive groupings, for a total of 45 comprehensive variables. These included items such as average tree diameter across all species, total herbaceous cover of grasses, forbs, and shrubs (oven-dry weight lbs/acre), and the total number of trees/acre within various diameter categories for similar tree species types (pine, fir, juniper, or oak).

RESULTS

Biophysical Characteristics

Average tree basal area per site ranged from approximately 50 square feet/acre to 225 square feet/acre. Average ponderosa pine tree diameters across sites ranged from 1.4 to 25.6 inches dbh; average tree diameters (dbh or diameter at root collar) for other tree species ranged from zero to 14.3 inches. The average herbage weight (oven-dry weight) across sites ranged from six to 200 lbs/acre for grasses, one to 202 lbs/acre for forbs, and zero to 59 lbs/acre for shrubs.

Visitor Characteristics

The male to female ratio of campground visitors surveyed was 9:11. Ages ranged from 15 to 84 years with a mean of 45 years. The average household size at a campsite consisted of 3 family members, with size ranging from one to 12 members. The modal

value for household income fell between $30,000 and $40,000. The length of stay for a campground visitor ranged from one to 14 days, averaging four days per stay. Nearly 94 percent of the campground visitors surveyed were Arizona residents; an additional five percent were either California, Nevada, Texas, or Utah residents.

SBE Values

Overall, the average camper SBE value for a campground area ranged from -91 to 85. Since the location of the zero-point on a SBE scale is arbitrary, these values only represent relative differences between scenes (Daniel and Boster 1976, Brown and Daniel 1984).

In a preliminary test, strong correlations (0.80 and greater) were obtained when comparisons were made between the SBE ratings of campers and those of university students for the campground scenes and general forest landscapes, and under varying rating instruction types. Similar results have been obtained from researchers when scenic beauty judgment comparisons were made between general public and university student groups (Daniel and Boster 1976, Arthur 1977). Using university student groups to predict camper scenic beauty is more efficient than surveying campground users since larger quantities of data can be collected in a shorter time period and campers do not have to be disturbed in the field. Student group SBE ratings ranged from -75 to 69, -75 to 87, and -61 to 70 for individual

campground scenes. Again, these values represent relative differences between scenes.

Current Model Tests

Based on model tests (Table 1, Table 2), the predictive ability of the current SBE models (as a whole) was found to be unsatisfactory. All the model test correlation coefficients were below the minimum critical correlation of 0.60. In addition, although associations are weak (indicated by correlation coefficients closer to 0.00 than -1.00 or +1.00), many of the correlation coefficients were negative. This indicates that an increase in the actual SBE value would be accompanied by a decrease in the predicted SBE value. This type of association is counterintuitive (areas judged to have the highest scenic beauty are predicted to have the lowest). In addition, the smallest PRMS:ORMS ratio obtained was 2.0 and most of the ratios were much larger.

Campground Scenic Beauty Models

Overall, very few variables were found to be significant. Significant variables included average tree diameter across all species per site, average tree diameter of ponderosa pine trees per site, number of ponderosa pine trees/acre from 5.0 to 15.9 inches dbh, number of trees/acre from 5.0 to 10.9 inches dbh, tree grouping (degree of tree spacing), and total oven-dry weight of herbaceous species (lbs/acre). All variables are continuous

with the exception of the tree grouping variable. The tree grouping variable is a categorical variable with four site categories: (1) trees in groups with many interlocking crowns, (2) some tree grouping, but little interlocking crowns, (3) very little tree grouping, and (4) no tree grouping, trees evenly spaced. Model coefficients were estimated using least squares analysis. Eighty percent of the data (estimation data subsets) were used for significance testing while 20 percent of the data (prediction data subsets) were randomly selected for model validation.

Selected campground scenic beauty models were found to be satisfactory based on validation procedures. A Pearson correlation analysis compared actual SBEs to predicted SBEs based on the prediction data subsets. Correlation coefficients of 0.79, based on the GENERAL data, and 0.76, based on the PINE data were obtained. As a second validation procedure, the ORMS, a measure based on the estimation data subset, was compared to the PRMS, a measure obtained from the prediction data subset. A PRMS:ORMS ratio of 1.4 was obtained for both of the campground models. Following model validation, model coefficients were refined based on the entire biophysical data sets.

The following GENERAL campground scenic beauty model, yielded an adjusted R^2 value of 0.51:

$$SBE = -7.9701 + 1.6495\ PPDBH - 0.0975\ PP516 - 6.6596\ GROUPING + 0.0224\ OVENTOT$$

As evidenced by the model coefficients, increases in the SBE

measure are associated with increases in the average diameter of ponderosa pine trees (PPDBH) and total herbage weight (oven-dry weight lbs/acre)(OVENTOT) found at a campground site. Decreases in the SBE measure are associated with increases in the number of ponderosa pine trees five to 15.9 inches dbh (trees/acre)(PP516) and the degree of evenly spaced trees (GROUPING) around campground sites. Similar relationships, with the exception of the GROUPING variable, have been found in past scenic beauty modeling efforts (Brown 1983, Brown and Daniel 1984). Additional model statistics can be found in Table 3. Non-linear data transformations were not necessary for this model due to the homogeneity of residuals.

Independent variable contributions to SBE were also examined for the GENERAL model. Changes in SBE were plotted against changes in the GENERAL model independent variables (Figure 3).

The following PINE campground scenic beauty model, yielded an R^2 value of 0.50:

SBE = -13.6863 + 1.5435 PPDBH - 0.0968 PP516

According to this model, the SBE measure, in relation to campground sites, is positively related to the PPDBH variable and negatively related to the PP516 variable. Additional model statistics can be found in Table 4. Non-linear data transformations were not necessary for this model due to the homogeneity of residuals.

To examine independent variable contributions to SBE for

the PINE model, changes in SBE were plotted against changes in the PINE model independent variables (Figure 4).

DISCUSSION

Scenic beauty prediction with current models using camper SBE ratings may have been somewhat limited since camper ratings were given for photographs taken in May and forest inventory measures incorporated into models were reflective of campground conditions the following August. However, although the models were developed for general public groups and general forest scenes, the models were unsatisfactory in campground scenic beauty prediction even when based on the ratings of general university students who were informed that the sites to be rated were general forest scenes. This implies that rating differences are caused by biophysical differences rather than by the use of different criteria in rating general forest and campground scenes. Therefore, different key biophysical variables or current model coefficients are needed in models useable for campground scenic beauty prediction.

As with the GENERAL model, changes in the independent variables of the PINE model were limited to the range of data measures found in the data sets used to build models. Therefore, caution should be taken if prediction of SBE with these models is based on measures for independent variables outside these ranges.

One potential source of unexplained variance, as related to

site-level models, is how well the forest inventory conducted at individual inventory points actually represents the area (Brown 1983, Brown and Daniel 1984). For example, biophysical features measured in a forest inventory on a densely forested site may not be represented by a photograph of the site. In addition, the opposite may occur on sparsely forested sites; biophysical features seen in photographs of the sparsely forested site may not be measured in a forest inventory of the site. Also, forest inventories conducted at each of the individual campground inventory points were sampled for 360 degrees around the center of each point, but, only one photograph was taken in one direction at each point. As a result, much of an individual campground inventory plot is represented by the physical measurements taken with the forest inventory, but only a little is represented by the single photograph of the site.

Brown (1983) suggests that as the number of photographs which represent an individual site increases, such as from one to four photographs, the effectiveness of the use of the photographs to represent a site and the explanation of variance in regression analysis improves dramatically. However, only one photograph was taken at an individual campground point (in this study) in order to try to represent the biophysical characteristics surrounding campground areas while avoiding all man-made features. This study was intended to determine how individuals rated the biophysical characteristics of campground areas, in terms of scenic beauty, and not how they would rate

the actual man-made facilities at a campground site.

In general, it appears that the campground scenic beauty models work reasonably well for northern Arizona campground areas, according to validation procedures. Although the GENERAL model could be useful to recreation managers since it was developed to be applicable for a variety of different campground landscape types, application of the PINE campground model is recommended over the application of the GENERAL campground model.

The GENERAL campground model may be misleading since it appears that some biophysical (independent) variable associations with scenic beauty, either positive or negative, can be reversed under different forest type conditions based on data from this study. The GENERAL data set was divided into the following three subsets: (1) a subset with ponderosa pine inventory plots (n = 107), (2) a subset with juniper inventory plots (n = 12), and (3) a subset with mixed-conifer data plots (n = 11). An analysis was conducted to obtain Pearson correlation coefficients relating the GENERAL campground model dependent variable (SBE) to each of the independent model variables based on the above three subsets (Table 5).

According to the ponderosa pine and mixed-conifer data subsets, campground areas represented by larger ponderosa pine tree diameters and evenly spaced trees are preferred to campground areas represented by smaller ponderosa pine tree diameters and characterized by many interlocking tree crowns.

But, in relation to the juniper data subset it appears that these relationships are reversed. Therefore, there are contradictory conclusions that could be drawn with respect to scenic beauty relationships depending on what forest type is of concern.

Although a scenic beauty model applicable to campgrounds in a range of forest conditions in the ponderosa pine zone would be useful to forest management, it appears that the data set available with this study was not adequate to reasonably represent scenic beauty associations for the predominant pine, juniper, and mixed-conifer campground areas simultaneously (only 23 of the 130 GENERAL data points were representative of the juniper and mixed-conifer campground study sites).

With the recommended PINE campground model overstory characteristics, as represented by the PP516 and PPDBH variables, should be of primary management concern for campground areas in northern Arizona. This does not mean that the understory characteristics should be of no concern for campground areas, but the most important management scenic beauty considerations for campground areas should be directed at the overstory characteristics.

CONCLUSIONS

The results of this study have several management implications. It appears that noticeable differences in biophysical forest conditions, related to scenic beauty, may occur for campground areas versus general forest scenes. It appears that there are different key biophysical variables which should be used as predictors of scenic beauty for each landscape type. This conclusion was based primarily on the tests of the current SBE models. According to the current model tests, it was determined that key variables used to predict scenic beauty for general forest scenes did not perform well in predicting scenic beauty for campground areas. Therefore, it is apparent that different key variables for campground areas are needed and management considerations related to scenic beauty should also differ for these two types of areas.

In addition to general guidelines relating spatial factors to campground site selection and results from recreational impact studies identifying what potential sites have the best capabilities to withstand recreational use, the PINE campground scenic beauty model is another tool that can aid managers in decisions for campground areas. For example, the scenic quality of a group of existing campground areas can be rated and compared by obtaining an average SBE value for each site. Another use of the PINE model may be in aiding decisions as to how an existing campground area could be improved. For example, according to the PINE model, the scenic beauty for an existing

site may be improved by reducing the number of ponderosa pine trees between five and 15.9 inches dbh.

Although the PINE model is based on data for existing campground sites, it can also be used as a tool in the selection of new campground areas. This is especially true since the emphasis of the PINE model is on forest overstory characteristics. For example, some of the primary forest condition features that are likely to change around newly developed campground areas are downed wood and herbage characteristics. Although a large quantity of downed wood may initially be a detriment in terms of scenic beauty for established campground areas, most downed wood (within reason) around campground areas is likely to be used by campground visitors as firewood within a very short period. Also, although understory herbage is likely to be trampled within campground sites, understory characteristics are not key variables related to scenic beauty in the PINE model. While there should be a concern for understory features due to ecological considerations and managers should be using other tools such as recreational impact guidelines to aid decisions for recreation areas, it appears that primary management concerns for scenic beauty do not have to be focused on changes that may occur to the understory. The PINE model could also be used to determine how the forest overstory characteristics for a potential campground site could be improved before the site is opened to the public (again, perhaps through a thinning of ponderosa pine trees five to 15.9

caution outside of northern Arizona until tests are conducted to determine if the PINE model performs for other ponderosa pine campground areas. The PINE model is a site-level model, thus it would be advantageous if further modeling efforts lead to a stand-level campground model. According to Brown and Daniel (1984), stand-level SBE models appear to explain a higher proportion of the variance in SBE than site-level SBE models (for general forest areas) since some of the forest inventory sampling problems associated with site-level models are alleviated.

Figure 1. Brown and Daniel scenic beauty models (a)

Basic Site-Level Model (SIB Model):

SBE = -16.34 - 0.0087 PPSAP - 0.0281 PP516 + 0.9246 PP24PL
- 0.3546 PDTOT + 2.6896 PDTOT75 - 0.0036 DWTOT

Basic Stand-Level Model (STB Model):

SBE = -32.47 + 4.6999 PP24PL + 0.3806 PDTOT

Overstory Stand-Level Model (STO Model):

SBE = -41.17 + 5.5076 PP24PL + 22.5761 TG

where
SBE = Scenic beauty estimate
PPSAP = Ponderosa pine sapling (trees/acre)
PP516 = Ponderosa pine 5.0 to 15.9 inches dbh (trees/acre)
PP24PL = Ponderosa pine $\geq$ 24.0 inches dbh (trees/acre)
PDTOT = Herbage weight (lbs/acre)
PDTOT75 = Herbage weight*75 (lbs/acre)
DWTOT75 = Downed wood (cubic feet/acre)
TG = Tree grouping

(a) Source: Brown and Daniel 1984.

Figure 2. Schroeder and Daniel scenic beauty models (a)

Ponderosa Pine (site-level) model (PIPO model):

$$SBE = 3.43 + 0.0808\ GF + 0.3503\ PPL - 0.0160\ SL + 0.6180\ SH - 0.0795\ PPM$$

Mixed Species (site-level) model (MIXED model):

$$SBE = 1.33 + 0.0847\ F + 0.0066\ A + 0.6269\ PPL + 0.0845\ G - 0.0125\ SL + 0.0129\ FI + 0.0139\ J + 0.0036\ OK - 0.0350\ PPM$$

where

SBE = Scenic beauty estimate
GF = Grass and forbs (lbs/acre)
PPL = Ponderosa pine > 16.0 inches dbh (trees/acre)
SL = Slash (cubic feet/acre)
SH = Shrubs (lbs/acre)
PPM = Ponderosa pine 5.0 to 16.0 inches dbh (trees/acre)
A = Aspen (trees/acre)
FI = Fir (trees/acre)
J = Juniper (trees/acre)
OK = Gambel Oak (trees/acre)
F = Forbs (lbs/acre)
G = Grass (lbs/acre)

(a) Source: Schroeder and Daniel 1981.

Table 1. Correlation coefficients for actual SBE ratings vs. predicted SBE ratings by SBE model

Predicted Basis (a)	Actual Basis: Camper Ratings	Actual Basis: Student Ratings
Procedure 1 (b)		
STB	0.06	--
STD	0.09	--
SIB	0.01	-0.32
PIPO	-0.15	0.34
MIXED	0.13	0.53
Procedure 2 (c)		
STB	0.06	--
STD	0.25	--
SIB	0.10	-0.35
PIPO	-0.15	0.38

(a) listed by model used to obtain predicted rating. Models are referenced by model abbreviations and presented in Figure 2 and Figure 3.

(b) scenic beauty prediction for procedure one was based on all campground scenes (12 camper SBE stand-level ratings and 130 student SBE site-level ratings).

(c) scenic beauty prediction for procedure two was based on campground scenes that are predominantly of the ponderosa pine forest type (10 camper SBE stand-level ratings and 107 student SBE site-level ratings).

Table 2. Predicted residual mean square and observed residual mean square comparison

Model Basis (a)	PRMS/ORMS by Rating Basis	
	Camper	Student
Procedure 1 (b)		
STB	24.6	--
STO	5.5	--
SIB	5.9	4.7
PIPO	7.4	3.9
MIXED	12.4	2.0
Procedure 2 (c)		
STB	26.2	--
STO	4.6	--
SIB	3.7	5.1
PIPO	8.2	3.9

(a) Models are referenced by model abbreviations and presented in Figure 2 and Figure 3.

(b) scenic beauty prediction for procedure one was based on all campground scenes (12 camper SBE stand-level ratings and 130 student SBE site-level ratings).

(c) scenic beauty prediction for procedure two was based on campground scenes that are predominantly of the ponderosa pine forest type (10 camper SBE stand-level ratings and 107 student SBE site-level ratings).

Table 3. GENERAL Campground Scenic Beauty Model

Terms in the equation	Model Coefficients (a)
PPDBH	1.6495 (0.00)
PP516	- 0.0975 (0.00)
GROUPING	- 6.6596 (0.01)
OVENTOT	0.0224 (0.03)
Constant	- 7.9701
Model summary statistics	
R^2	0.53
Adjusted R^2	0.51
Standard error	18.20
F (dfrg, dfrs)(b)	34.76 (4, 125)
Significance F	0.00

(a) the values in parentheses indicate the significance level of the independent variables.
(b) F statistic (degrees of freedom regression, degrees of freedom residual).

Table 4. PINE Campground Scenic Beauty Model

Terms in the equation	Model Coefficients (a)
PPDBH	1.5435 (0.00)
PP516	- 0.0968 (0.00)
Constant	- 13.6863

Model summary statistics

R^2	0.51
Adjusted R^2	0.50
Standard error	17.65
F (dfrg, dfrs)(b)	54.22 (2, 104)
Significance F	0.00

(a) the values in parentheses indicate the significance level of the independent variables.
(b) F statistic (degrees of freedom regression, degrees of freedom residual).

Table 5. Correlation coefficients between the SBE measure and selected data variables based on forest type data sets

Forest Type Data Set	Variable			
	GROUPING	PPDBH	PP516	OVENTOT
Juniper (a)	-0.29	-0.11	-0.12	0.63
Mixed-Conifer (b)	0.34	0.84	-0.51	0.06
Pine (c)	0.34	0.63	-0.68	0.44

(a) the juniper forest type data set contains 12 inventory plots.
(b) the mixed-conifer forest type data set contains 11 inventory plots.
(c) the ponderosa pine forest type data set contains 107 inventory plots.

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E1

1985 FOREST RECREATION STUDY
UNIVERSITY OF ARIZONA/NORTHERN ARIZONA UNIVERSITY
Scenic Beauty

CAMPGROUND_____ CAMPSITE_____ INTERVIEW # _____

DATE _____ TIME _____ INTERVIEWER

SEX: MALE ____ FEMALE ____ T/M 1 2 3 4

_____ 1. a. When did you arrive at this campground?
MONTH/DAY/a.m.,p.m.

_____ b. When do you expect to leave?
MONTH/DAY/a.m.,p.m.

_____ 2. How many people, including yourself, are with you at this campsite?

_____ 3. a. Are all of you from the same household?

[IF YES, SKIP TO QUESTION 4]

_____ b. How many households are represented in your party?

_____ c. How many members of your household including yourself, are there?
(a,b,c,d,e)

4. We need some information about your trip.

_____ a. Where is your current residence?

_____ b. Is this campground the only place in Arizona you plan to stay overnight on this trip?

[IF YES, GO TO 4c]
[IF NO, GO TO 4d]

_____ c. About how many hours did you travel from home to get here? [GO TO 5]

_____ d. Where else in Arizona will you stay overnight on this trip?

_____

[List in order; if respondent is from outside Arizona, determine if there is a temporary "home base" in the state (e.g., a summer cabin, etc.) that could be the origin for several trips]

_____

_____

_____ e. When (date) did you arrive at (place 1) on this trip?

_____ f. When (date) will you leave (place N)?

[GO TO 5]

E2

_____ 5. Is this your first visit to this campground?

[IF NO, SKIP TO 5b]

_____ a. Do you think you will camp here again?

[SKIP TO 6]

_____ b. About how many times have you camped here?

_____ 6. Is this campground your first choice for this (part of your) trip?

[IF YES, SKIP TO QUESTION 7]

_____ a. What campground was your first choice?

[IF NONE, SKIP TO 7]

_____ b. Why didn't you camp there?

[ASK ONLY OF HOUSEHOLD DECISION MAKERS. OTHERWISE, GO TO SCENIC BEAUTY]

WE ARE INTERESTED IN THE VALUE OF THIS CAMPGROUND TO THE PEOPLE WHO VISIT IT. YOU CAN HELP US BY ANSWERING A FEW QUESTIONS ABOUT YOUR EXPENSES FOR THIS TRIP AND ABOUT SOME HYPOTHETICAL SITUATIONS.

_____ 7. About how much do you think <u>your household</u> will spend on gas for this (the Arizona part of your) trip?

_____ 8. About how much do you think <u>your household</u> will spend on food and beverages for this (the Arizona part of your) trip?

_____ 9. What will be the total of your campground and rental fees for this (the Arizona part of your) trip?

That makes a total of about _____ dollars your household will spend for this (the Arizona part of your) trip. (Over the ____ days of your trip that would make about $_____ per day. Suppose then that we use $_____, ____ days at $_____ per day, to represent your expenses for this part of your trip--does that seem reasonable?)

THIS NEXT QUESTION IS HYPOTHETICAL. ONE WAY THAT HAS BEEN USED TO GET AN IDEA OF THE VALUE PEOPLE PLACE ON THEIR RECREATION EXPERIENCES IS TO ASK WHAT THEY WOULD BE WILLING TO SPEND FOR THE EXPERIENCE. FOR EXAMPLE, YOU HAVE ESTIMATED THAT YOU WILL SPEND $_____ FOR THIS (PART OF YOUR) TRIP. WE ARE INTERESTED IN KNOWING HOW MUCH MORE YOU (HOUSEHOLD) WOULD HAVE BEEN WILLING TO SPEND ON THIS TRIP BEFORE DECIDING NOT TO COME TO THIS CAMPGROUND--THAT IS, BEFORE DECIDING TO DO SOMETHING ELSE OR TO STAY AT HOME.

_____ 10. How much <u>more</u> do you think you would have been willing to spend?

[BE SURE THE AMOUNT GIVEN IS <u>HOW MUCH MORE</u>]

E3

Book #_____

11. How many camping trips did you take in the past 12 months?

_____

12. Of those, how many were to this campground? _____

13. What is your postal zip code?

_____

14. What is your age? _____

15. What is your annual household income from all sources? (before taxes)? Please check ( ) the appropriate box.

/__/ under $5,000
/__/ $5,000 - $9,999
/__/ $10,000 - $14,999
/__/ $15,000 - $19,999
/__/ $20,000 - $24,999
/__/ $25,000 - $29,999
/__/ $30,000 - $39,999
/__/ $40,000 - $49,999
/__/ $50,000 - $74,999
/__/ $75,000 - $99,999
/__/ $100,000 or more

RESPONSE SHEET

Please assign a Scenic Beauty Rating to each forest area depicted. 1 = Very Low Scenic Beauty, 10 = Very High Scenic Beauty.

Area 1. _____
Area 2. _____
Area 3. _____
Area 4. _____
Area 5. _____
Area 6. _____
Area 7. _____
Area 8. _____
Area 9. _____
Area 10. _____
Area 11. _____
Area 12. _____
Area 13. _____
Area 14. _____
Area 15. _____
Area 16. _____
Area 17. _____
Area 18. _____
Area 19. _____
Area 20. _____
Area 21. _____
Area 22. _____
Area 23. _____
Area 24. _____
Area 25. _____
Area 26. _____
Area 27. _____
Area 28. _____
Area 29. _____
Area 30. _____
Area 31. _____
Area 32. _____
Area 33. _____
Area 34. _____
Area 35. _____

Rate the Scenic Beauty of the forest area around this campground

_____

Please answer the few additional questions on the left side of this page.

(F1)

1985 FOREST RECREATION STUDY
UNIVERSITY OF ARIZONA/NORTHERN ARIZONA UNIVERSITY
Contingent Valuation

CAMPGROUND_____ CAMPSITE_____ INTERVIEW # _____

DATE _____ TIME _____ INTERVIEWER

SEX: MALE ____ FEMALE ____ T/M 1 2 3 4

_____ 1. a. When did you arrive at this campground?
MONTH/DAY/a.m.,p.m.

_____ b. When do you expect to leave?
MONTH/DAY/a.m.,p.m.

_____ 2. How many people, including yourself, are with you at this campsite?

_____ 3. a. Are all of you from the same household?

[IF YES, SKIP TO QUESTION 4]

_____ b. How many households are represented in your party?

_____ c. How many members of your household including yourself, are there?
(a,b,c,d,e)

4. We need some information about your trip.

_____ a. Where is your current residence?

_____ b. Is this campground the only place in Arizona you plan to stay overnight on this trip?

[IF YES, GO TO 4c]
[IF NO, GO TO 4d]

_____ c. About how many hours did you travel from home to get here? [GO TO 5]

_____ d. Where else in Arizona will you stay overnight on this trip?

_____

[List in order; if respondent is from outside Arizona, determine if there is a temporary "home base" in the state (e.g., a summer cabin, etc.) that could be the origin for several trips]

_____

_____

_____ e. When (date) did you arrive at (place 1) on this trip?

_____ f. When (date) will you leave (place N)?

[GO TO 5]

(F2)

_____ 5. Is this your first visit to this campground?

[IF NO, SKIP TO 5b]

_____ a. Do you think you will camp here again?

[SKIP TO 6]

_____ b. About how many times have you camped here?

_____ 6. Is this campground your first choice for this (part of your) trip?

[IF YES, SKIP TO QUESTION 7]

_____ a. What campground was your first choice?

[IF NONE, SKIP TO 7]

_____ b. Why didn't you camp there?

[ASK ONLY OF HOUSEHOLD DECISION MAKERS. OTHERWISE, GO TO SCENIC BEAUTY]

WE ARE INTERESTED IN THE VALUE OF THIS CAMPGROUND TO THE PEOPLE WHO VISIT IT. YOU CAN HELP US BY ANSWERING A FEW QUESTIONS ABOUT YOUR EXPENSES FOR THIS TRIP AND ABOUT SOME HYPOTHETICAL SITUATIONS.

_____ 7. About how much do you think <u>your household</u> will spend on gas for this (the Arizona part of your) trip?

_____ 8. About how much do you think <u>your household</u> will spend on food and beverages for this (the Arizona part of your) trip?

_____ 9. What will be the total of your campground and rental fees for this (the Arizona part of your) trip?

That makes a total of about $\$$____ dollars your household will spend for this (the Arizona part of your) trip. (Over the ____ days of your trip that would make about $\$$_____ per day. Suppose then that we use $\$$_____, ____ days at $\$$_____ per day, to represent your expenses for this part of your trip--does that seem reasonable?)

THIS NEXT QUESTION IS HYPOTHETICAL. ONE WAY THAT HAS BEEN USED TO GET AN IDEA OF THE VALUE PEOPLE PLACE ON THEIR RECREATION EXPERIENCES IS TO ASK WHAT THEY WOULD BE WILLING TO SPEND FOR THE EXPERIENCE. FOR EXAMPLE, YOU HAVE ESTIMATED THAT YOU WILL SPEND $\$$ 61 FOR THIS (PART OF YOUR) TRIP. WE ARE INTERESTED IN KNOWING HOW MUCH MORE YOU (HOUSEHOLD) WOULD HAVE BEEN WILLING TO SPEND ON THIS TRIP BEFORE DECIDING NOT TO COME TO THIS CAMPGROUND--THAT IS, BEFORE DECIDING TO DO SOMETHING ELSE OR TO STAY AT HOME.

_____ 10. How much <u>more</u> do you think you would have been willing to spend?

[BE SURE THE AMOUNT GIVEN IS <u>HOW MUCH MORE</u>]

F3

Book #_____

RESPONSE SHEET

11. How many camping trips did you take in the past 12 months?

_____

12. Of those, how many were to this campground? _____

13. What is your postal zip code?

_____

14. What is your age? _____

15. What is your annual household income from all sources? (before taxes)? Please check ( ) the appropriate box.

/__/ under $5,000
/__/ $5,000 - $9,999
/__/ $10,000 - $14,999
/__/ $15,000 - $19,999
/__/ $20,000 - $24,999
/__/ $25,000 - $29,999
/__/ $30,000 - $39,999
/__/ $40,000 - $49,999
/__/ $50,000 - $74,999
/__/ $75,000 - $99,999
/__/ $100,000 or more

MAXIMUM TRIP EXPENDITURE ESTIMATE FOR CURRENT SITE = $_____ E1+10

On the lines below, please indicate the most you would have been willing to spend on this trip if forest conditions at this campground (all other things being equal) were like the forest areas depicted in the photos.

Area 1. $_____
Area 2. $_____
Area 3. $_____
Area 4. $_____
Area 5. $_____
Area 6. $_____
Area 7. $_____
Area 8. $_____
Area 9. $_____
Area 10. $_____
Area 11. $_____
Area 12. $_____
Area 13. $_____
Area 14. $_____
Area 15. $_____
Area 16. $_____
Area 17. $_____
Area 18. $_____
Area 19. $_____
Area 20. $_____
Area 21. $_____
Area 22. $_____
Area 23. $_____
Area 24. $_____
Area 25. $_____
Area 26. $_____
Area 27. $_____
Area 28. $_____
Area 29. $_____
Area 30. $_____
Area 31. $_____
Area 32. $_____
Area 33. $_____
Area 34. $_____
Area 35. $_____

Please answer the few questions on the left side of this page.